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Engineers in the British Navy.

That long struggle to secure for engineers of the navy an equal rank with line officers, which was waged in the United States until about a year ago, when it culminated in the enactment of a law reorganizing the naval service, is being fought over nearly the same ground in Great Britain. The Board of Admiralty has already approved certain changes, appointing some additional inspectors of machinery, giving the engineer-in-chief relative rank of a rear admiral, ranking chief engineers with lieutenants of and above eight years' seniority, ranking engineers on promotion with lieutenants of less than eight years' seniority, and slightly increasing the pay. Leading British technical journals fail to accept this action as other than a meager instalment of reform, and they have lately contained some strong editorials upon the merits of the question.

"Engineering" designates this relative rank as absolute foolishness almost beyond belief. Either the engineer is worthy of rank, it says, or he is not. He performs arduous official military duties, but he is given the status of a civilian. Sir John Durston, the engineer-in-chief, ranking relatively as a rear admiral, might, if ordered to sea, find himself, by a sudden official mortality, under the orders of a gunner or boatswain, or even an able-bodied seaman. Without the aid of the military branch an engineer has no power to enforce any order he may give to even the humblest stoker, for he has no power to punish.

The question, as the journal named further points out, has a wider bearing than the relative rights of executive and engineering officers, or even that sacred thing, "the good of the service." Such a complex machine as a fighting ship requires an intelligence and scientific training of the highest order. The South African war has taught the British nation that there are weak spots in its vaunted military system, and there is reason to think that a big naval war would show the existence of one right here. "It is in the machinery department that failure is most likely to occur; in fact, the whole ship is machinery, so it could hardly happen elsewhere. Numerically, the engineering staff is dangerously weak, and for years past the Admiralty have been making bad substitutes for engineers. They have tried to convert stokers into artificers, and artificers into engineers, while the engineers themselves have had thrust upon them more and more useless clerical work, the preparation of returns never to be read, and other demands created by thoughtless regulations of which the creators have been too ignorant or too idle to discover the uselessness."

A reform advocated as the most pressing is an adequate representation of the engineering staff on the Board of Admiralty. It would be difficult to find material of which to make a suitable engineering Lord, however, for that branch of the service has been trained in such abject subordination to the executive that few of its votaries would be likely to exert a powerful independent influence in such a position. One present hindrance in bringing to bear an effective pressure for reforms upon the conservative Board of Admiralty is the stolid apathy of the engineers themselves, a majority of the older ones being averse to stirring up the question of rank.

The "Mechanical Engineer" also dwells upon the grave need of a better engineering service system, referring to a paper by Mr. D. B. Morison, before the North-east Coast Institution of Engineers. It points out the magnitude of the mechanical requirements in the navy and the few experienced men in the service to meet them. It shows that the engineer does not possess adequate means for controlling his subordinates; also that in the trial of his own conduct, even involving technical questions, he has not the advantage of judgment by any of his own profession. A case illustrating the latter point arose some years ago on H. M. cruiser "Blake." A court of five captains severely reprimanded and dismissed from the ship the senior engineering officers for failing to superintend personally an artificer installing a water-gage glass, although it was shown that important work connected with getting the ship under way demanded their presence elsewhere.

European and American Commercial Competition.

A recent article by George Wenlersse in the "Grande Revue" says, in part:

"The danger is already at our threshold and is making itself felt. Brutal figures prove this fact most conclusively. A revolution which will change the commercial balance of power is taking place before our eyes. Until recent years, the Americans have been the best customers of European industries; they are now our competitors, and in very many branches have beaten us in the world's markets."

Mr. Wenlersse pays especial attention to the foothold which American manufacturers have gained in the Far East. The United States has succeeded in flooding China and Japan with guns, leather products of all kinds, machines of every description, electrical motors, etc.

"Gradually the Americans are pushing their way into the British colonies. The last railroad built in India has American rails. American manufacturers export their iron and motors, their machinery, and galvanic wires to Cape Colony. Egypt, too, has Philadelphia bridge builders on the scene. Three hundred railroad coaches have found their way from Jersey City into the land of the Pharaohs, and electrical tramways are forged in the foundries of Pittsburgh to connect Cairo with the pyramids. Even Europe is not safe

against the invasion of American goods. Russia, France, Germany and Italy must pay tribute. England herself buys American locomotives, steel rails, paper ware, railroad coaches, and even coal. Sheffield, the home of the steel industry, has been dethroned by Pittsburgh. It would be frivolity itself to remain indifferent to the expansion of this leviathan people."

One might conclude from the language of the above quotation that our steel rails, trolley cars, locomotives and machine tools constitute a plague when they invade a foreign country; that crops refuse to grow and children sicken and die wherever our exported machinery is found. The fact is, however, that our machinery is purchased to do work in the service of humanity. The men who buy and use it do so because they want to, not because they are forced to do so, and the results are beneficial, and not at all a blight, as Mr. Wenbersse evidently considers them.

Technical Publications.

"Machinists' and Draftsmen's Handbook, containing tables, rules and formulas, with numerous examples explaining the principles of mathematics and mechanics as applied to the mechanical trades, etc." By Peder Lobben. New York, D. Van Nostrand Company. 438 pages, 7¾x5½ inches. Price, $2.50.

This book, which has been compiled by an old and, at one time, frequent contributor to our columns, is quite correctly described on its title page, which is only partially reproduced above. It contains many of the familiar and most useful tables, with explanations and examples not usually given, and the matter is all available to one with only a common school education. It should be a handy and serviceable book for the man who works in the shop and wants to figure on what he is doing.

"The Gas Engine Handbook: A Manual of Useful Information for the Designer and Engineer." By E. W. Roberts, M. E. The Gas Engine Publishing Company, Cincinnati. 220 5½x3¾-inch pages, 39 cuts. Price $1.

The author of this little book has gathered into a small space all of the most essential information connected with the gas or gasoline engine, such information as the designer must have and as the engine runner should have. The principle of operation is described and the three different "cycles," the four cycle, the two cycle and the Diesel motor, are discussed, and the comparative advantages and disadvantages of each pointed out. The details of the engine are then treated in separate chapters, simple formulas being given where called for. At the end some special attention is given to modes of testing gas engines. The book is well indexed and should be a handy companion for those who require information in this special line. The only suggestion of padding in connection with the book is a table of circumferences and areas of circles at the end of it.

"Dynamometers and the Measurement of Power. A treatise on the construction and application of dynamometers, with a description of the methods and apparatus employed in measuring water- and electric-power." By John J. Flather. New York, John Wiley & Sons. 404 pages 7¼x5 inches. Price, $3.

This book collects in convenient form, for the use of the technical student and the engineer, a description of the various types of dynamometers, detailed explanations of the best ways in which to apply and use them, and various valuable information which has been accumulated by their aid. The work has been used as the basis of a course of lectures to engineering students, and is the outgrowth of a series of articles which appeared in our columns. This second edition of the work is considerably enlarged and improved, five new chapters having been added and others rewritten. New forms of transmission dynamometers are discussed, and the measurement of water power has been extended with new material on the Venturi meter and on meter testing. The measurement of electric power is a new phase of the problem which has called for extensive new matter. The table of results of the power required to drive machine tools, given at the end of the book, is quite extensive, covering fifty pages, and includes the results of the numerous tests published in these columns in 1896. Those who have asked for the back numbers containing these tests, but who have been unable to obtain them, will be glad to know of their republication here.

Personal.

Charles Momm, superintendent of the Hardie-Tynes Foundry and Machine Company, of Birmingham, Ala., has accepted an appointment as assistant examiner, United States Patent Office.

Obituary.

William S. Merkel, of the firm of Schaeffer, Merkel & Co., builders of rolling-mill machinery, Fleetwood, Pa., died April 10, fifty-five years old.

E. H. Haskell died at Pawtucket, R. I., April 19, eighty years old. In 1845 he established a machine shop at Pawtucket, which developed into the E. H. Haskell Manufacturing Company, now employing 400 hands.

John Jessup Warren died April 15 at Stamford, Conn., sixty-eight years old. He learned the machinist's trade at the Novelty Iron Works, in this city, and later opened a machine shop at Stamford in partnership with Lewis Scofield. Over thirty years ago he became associated with the Stamford Foundry Company, being first its secretary and later its treasurer.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(11) W. M. W., Knox, Pa., says: To settle an argument, will you please say which is the front end of a stationary steam engine—the cylinder or flywheel end? A.—We think the usual and preferable practice is to call the flywheel end the front end. The opposite practice, where followed, is probably due to a supposed analogy with the locomotive. The cylinders are obviously at the front end of that machine, but that is no reason for following the same terminology with stationary engines. The fire door of a locomotive boiler is certainly at the back of that boiler, but no one thinks of calling the firing end of a stationary boiler the back end on that account, and there is no more reason that the locomotive *engine* should control the terms used than that the locomotive *boiler* should do it.

No one who is in any way interested in the foreign machine tool trade should fail to read the letter of "Ex. P. Rience" in another column of this issue. It gives the result of extensive and expensive experience, and comes from a mechanic whose great success in selling machine tools abroad enables him to speak with authority and to give advice of great value.

The New York Central & Hudson River Railway Company has announced an unsolicited uniform 10-per-cent. increase in the wages of all mechanics in every department of its car shops at East Buffalo.

A thermometer made of quartz and containing tin as a working fluid has been constructed by M. A. Dufour. It measures temperatures from 464 to 1076 degrees Fahr. Since quartz does not soften below 1800 to 2200 degrees, it is pronounced possible to make such a thermometer going as high as 1650 degrees. For determining temperatures somewhat above the range of an ordinary glass and mercury thermometer, engineers ought to find such an instrument very convenient.

The Wabash Railroad, after paying its employees with checks for fifteen years, is to go back to the old method of distributing cash from a pay car. The change is said to be made for the convenience of the employees and at their wish.

The seventh annual oyster roast (with all thereby implied) given to its employees and friends by the Berlin Iron Bridge Company takes place at the works on the evening of April 27, the usual happy time may be expected to be enjoyed by all concerned.

Commercial Review.

NEW YORK, Monday, April 23.

MACHINE TOOL MARKET.

A sensation has been created in the last few days by the closing of several mills of the American Steel and Wire Company, and this opens up to criticism conditions all through the market for iron and its products. The closing of those mills is generally admitted to have been a mere speculative and unconscionable maneuver. As to the pig iron market, prices have quietly been sagging off for several months past, particularly on Northern irons which had previously been advanced more in proportion than the Southern, but we have it on the authority of Rogers, Brown & Co. that the tendency to weaken is no more pronounced than it has been, and that a serious break is not anticipated.

An encouraging consensus of opinion in support of the activity and firmness of the machine tool market is formed by Messrs. Geier, of the Cincinnati Milling Machine Company; Hoeffinghoff, of the Bickford Drill and Tool Company, and Grant, of the Grant Machine Tool Company, who were in New York to-day at the office of the Prentiss Tool and Supply Company. These gentlemen are all at present experiencing most prosperous conditions in their own business, and with their acquaintance with the machine tool manufacturing field are emphatic in their contradiction of the view that representative tool builders are suffering from lack of demand, or from overstock, or that they are reducing their prices.

There is said to be a tendency at present to shift the carrying of stocks from the dealer to the manufacturer, irrespective of the demand from consumers, and this accounts in part for the increased stocks visible on manufacturers' hands. We learn, however, that the Prentiss Tool and Supply Company has just placed with the Bickford Drill and Tool Company a large order for drills for delivery in September, which does not look as if in that case there were a stock of drills piling up in the hands of either company.

The foreign market is an important factor in keeping shops full, and as this is a little sluggish at present there is hope of better things therefrom when manufacturers give it a fresh stirring up. A representative of well-known Continental firms dealing in American tools, who is now in this country, says that the South African war has caused a marked falling off of trade, particularly in London, where it is now very hard to find anyone to buy tools. He is fully assured that after the war is over there will be a renewal of placing orders. His view of the effect of the war is not entirely in accordance with some others. Mr. G. T. Montgomery, of this city, who has just returned from another trip abroad, met Mr. Charles Churchill, whom he found to be very busy, some of his trade apparently being attributable to the war. Mr. Montgomery says that the Paris store of his own interests is busier than the one in America; also that there is a heavy foreign demand in the water meter line, which is one of his specialties, coming from enterprises connected with the war. The representative of a leading Continental machine tool firm, whom we have also consulted, states that the Transvaal matter has not materially affected trade. He says that, while demand is not quite as brisk as it was last year, it is very healthy, and a continuance of its present state will be regarded as satisfactory.

The gravest problem that now confronts the machine tool building trade is how to get returns for its productiveness. The increase in output capacity in Cincinnati within two years past has amounted, according to different estimates, to from 40 to 75 per cent., and even more. Taking the country throughout the increase has been large, though probably much less than double. These extensions may not have been injudicious; they may not raise an ideal of output far beyond hope of attainment by consumption; but they certainly create responsibilities which require energy and courage to meet. The marketing of the vast quantity of tools now being turned out is a task which will absorb the best efforts of manufacturers and dealers in working old fields and opening up new ones throughout the world. He who soonest recognizes that job in front of him and begins to get about it will be the best off. What is needed before everything else, however, is a little philosophy, to teach that under these new output conditions a comparatively small retrogression in demand must quickly be felt in stocks on hand, so that a perceptible change in these is no indication that the gods are hostile or that business is going to the dogs.

The danger is that manufacturers who were too easily elated at the growing prosperity of 1898 and 1899 will be too easily discouraged at a slight abatement of such a condition, and that a reciprocity of discouragement among different industries will lead to a quite unnecessary scare, not to say slump. The general situation for machine tool men is still resplendently bright. The outlook is for a season of demand only exceeded in recent years by that of 1899. Mechanical lines which require machine tools are still hustling; new enterprises are being put in and old ones are being extended. An enormous amount of steam and electric plant work is being done. A prominent local engineering firm tells us that the steam plant trade is very healthy, and sufficient to hold prices firm for some time to come. A man who has been visiting the foundries and jobbing machine shops along the Hudson says that they are enjoying an active spring trade, and are perceptibly busier than two months ago. Such reports as those, and others published in our columns, show what the machine tool trade has to lean upon.

VARIOUS NOTES.

The acting Secretary of the Treasury, O. L. Spaulding, has submitted a letter to the House of Representatives asking for an appropriation of $150,000 for the purpose of purchasing machinery, including engines, boilers, etc., for the equipment of the new part of the Government printing office, at present under construction.

Work is progressing on the new plant of the Berlin Iron Bridge Company, of East Berlin, Conn., on the fifty acres of land purchased between the Ohio River and the Pennsylvania Railroad, near Pittsburgh. The foundations of the buildings are now being put in place, and it is the intention that the plant shall be in complete operation by the first of July, as the orders for the machinery equipment have been placed for some months. The machinery equipment will come from the Hilles & Jones Company, the Cleveland Punch and Shear Works Company, the Niles Tool Works Company and the Brown Hoisting and Conveying Company. The hydraulic plant will be very elaborate and will be furnished by William H. Wood, of Media, Pa. The floor surface of the main shop is to contain twenty-three traveling cranes of various sizes and design, of the heaviest capacity, all furnished by the Chisholm & Moore Manufacturing Company, of Cleveland, Ohio. The fuel used will be natural gas, the engines being furnished by the National Meter Company, of New York, N. Y. The machinery will be operated throughout by electricity, the generators and motors being furnished by the General Electric and Westinghouse Companies. The main shop, constructed entirely of steel and glass, will be 700x220 feet. There will be a 60x300-foot, two-story template shop, and a 60x60-foot, four-story office building. The capacity of the plant will be 3,000 to 4,000 tons per month. The company's New York office, which is in charge of Mr. Seymour N. Robinson, will be removed to the St. Paul Building, 220 Broadway.

Mr. C. C. Clark, of the Allerton-Clark Company, takes a sanguine view of the business outlook, judging from that of the Arcade File Works. March was probably the foremost month in their history, and April is running near it. The works are turning out about 2,000 dozen files a day, and have orders for a considerable time ahead, in spite of the late enlargement of the plant by a new factory. One quarter in which there are excellent business prospects, Mr. Clark says, is the Southern States.

The Colorado Springs (Colo.) Electric Company is having erected a power and lighting plant, and J. G. White & Co., of this city, are the engineers for it. They are calling for bids on the machinery for equipping it, which will comprise a 1,500-kilowatt alternating outfit to start with.

The boilers have already been ordered, through Thayer & Co., being five 400 horse-power horizontal water-tube ones, to be built by the Aultman & Taylor Company. They will have separate setting detached furnaces and shifting grates.

Manufacturers of machine tools and other metal working machinery in New York and its suburbs are fairly well represented, considering their number, among those of the country who are renewing or enlarging their plants. The Garvin Machine Company in Manhattan borough entered a large new building only about three years ago. The E. W. Bliss Company, of Brooklyn, is soon to make extensions, as noted in our last number. In Newark, Gould & Eberhardt have been making some considerable extensions to their shop. One of the latest additions is a 1,200-light Sprague dynamo, and motors have been installed for driving a few of their tools. Now it is announced that the Newark Machine Tool Works contemplate the erection of a new plant. The Delaware, Lackawanna & Western Railroad is coming across the site of the present shop, which happens quite opportunely, as the demand for the product of the works has for some time been altogether out of proportion to their limited capacity. The concern confines itself to the manufacture of one specialty—horizontal boring mills. The new building will probably be put up next fall or spring. The site has not yet been chosen, but will be near enough to some one of the railroads passing through Newark to get a siding.

CINCINNATI REPORT.

At this writing the difficulties that beset the large manufacturing concerns in the matter of sustaining amicable relations with their help is no nearer settlement than a week ago. A committee of the owners of the large machine tool making and allied concerns, which are now thoroughly organized with the Metal Trades Association, will come to some conclusion on Monday evening, April 23, as to just what reply will be made to the demands of the men. The employees have set Wednesday, April 25, as the date on which an answer must be received to their demands for nine-hours' work with ten-hours' pay. From what can be learned by discussing the situation with the largest manufacturers, there would seem to be no reason for believing that the demands will be granted. The wages of machinists vary so greatly here it is scarcely possible a uniform scale could be arranged.

An event of considerable interest to the manufacturers of Cincinnati was the recognition given local talent in the selection of John W. Dunn, formerly of the Laidlaw-Dunn-Gordon Company, of Cincinnati, to be president of the Internatioanl Steam Pump Company. It will be remembered that when this company was formed by a consolidation of the leading pump manufacturing concerns of the country, Mr. Dunn was made second vice-president. Since then he has been chiefly in the East.

Considerable interest is felt hereabouts in the organization and promised early operation of the American Rolling Mill Company, of Middletown, Ohio. President George M. Verity entertained at the Business Men's Club during the week the new general superintendent of the concern, James B. Strawbridge, formerly of Chicago. A considerable proportion of the product in the mills, steel and galvanized sheets from 30 to 10 gage, will be utilized by the American Steel Roofing Company, of Cincinnati, and the remainder will be sold to the trade. In view of the outlined intentions of the company, viz., the manufacture of steel for their own use, much speculation has been indulged in by manufacturers as to just how the venture will pan out. The officers maintain that they will not in any way antagonize any existing interest along the lines they have mapped out, and that they simply expect to supply the demands of the Cincinnati house and the trade in general. It is expected to have the plant in full operation not later than the middle of August.

CHICAGO MACHINERY MARKET.

It is difficult to estimate correctly the character of the market for machinists' tools at this city—there are so many varying influences at work. In a few words, it may be said to be a contest between the natural activity of the times and the depressing influences of the strikes. No one business is affected just exactly like another. So effectually are the building trades at Chicago tied up by the labor troubles that structures in all stages of progress have been neglected for months, while new work is piling up almost to an enormous extent, or would be were not a goodly portion of it killed by the protractedness of the idleness. Half-finished residences are boarded up, waiting for the end, and many prospective builders this year are reaching the conclusion that unless settlement is speedy they will defer until another season, or will wholly abandon their plans for property improvement. This deadens the trade effectually for plumbers, building hardware makers, manufacturers of gas fittings and similar lines. Their dullness in turn affects others, and the loss of wages, the deterrent effect of the troubles upon other enterprises, etc., are all contributing to the force of this brake upon progress. In the general machinists' supplies trade there has crept an element of partial inaction that is explainable in no other way. The unionizing of some shops is also disturbing the former equilibrium of manufacture. There are a number of instances like the following: The maker of an electrical machinery attachment, who has been employing about forty hands, of whom ten are skilled electricians earning three to four dollars per day, and the remainder mostly boys operating presses and other tools at five or six dollars per week, has just been informed that all apprentices and non-union labor must be discharged, and all the work in the shop done by the men at the regular scale, of about four dollars per day. This, he estimates, will so increase the cost of his product that he cannot see how he can continue his little factory. It will prove revolutionary to his manner of doing business.

But there is another side to the market. Out-of-town trade is uniformly pronounced good, and a summary of the whole would probably show a small decrease, both as compared with a month ago and a year ago, though to this statement there are, of course, many exceptions. And to the trade in its entirety no other term than active can be accurately applied. Brass goods are declining somewhat in value, and the opinion has general acceptance that iron and steel products have reached the top notch for the present. There is, therefore, little incentive for the holders of these views to buy above their immediate needs.

C. H. Besly & Co. report business better than a year ago. The Beloit (Wis.) plant is running fuller than ever, and the company is making extensive shipments to South America. The Chicago Belting Company numbers among its late orders one aggregating $10,000 for a cement works belting outfit. The order includes 500 feet of 48-inch, three-ply; 600 feet of 32-inch, three-ply; 2,000 feet of 18-inch, double, and 2,500 feet of 12-inch, double belting.

Quotations.

NEW YORK, Monday, April 23, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$22 45 @ $23 70
No. 2 X foundry	21 45 @ 22 70
No. 2 plain	19 95 @ 20 95
Alabama Irons:	
No. 1 foundry	22 25 @ 22 75
No. 2 foundry	21 25 @ 21 75
No. 3 foundry	20 25 @ 20 75
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 21 75
Foundry forge	19 50 @ 20 00

Bar Iron — Base sizes — Refined, mill price on dock, 2 @ 2.15c., with good brands selling at 2.40 @ 2.50c. from store.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.65 @ 2.85c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4.25c.

Copper—Lake Superior ingot, 17⅛ @ 17½c.; casting, 16¾ @ 17c.

Pig Lead—Wholesale lots, 4.70c., New New York, 31 @ 31¼c.

Spelter—Prime Western, 4¼ @ 4⅜c., New York delivery.

Antimony—Hallett's, 9⅝ @ 9¾c.

The Manufacture of Military Rifle Barrels.

BY E. G. PARKHURST.

From 1864 until the advent of small calibers (about 1890), little or no improvement had been made in special machinery for the manufacture of rifle barrels. The small caliber compelled those who manufactured barrels in large quantities to abandon old methods of obtaining the through bore, because of excessive cost. Roll them they could not; therefore some better and cheaper mode had to be devised, and the problem has been satisfactorily solved.

National and private armories in this and other countries have now adopted a method which was devised at the Pratt & Whitney Company's works in 1887, and perfected about 1892. By this system bores are made so straight and true that it eliminates 60 per cent. of the straightening caused by the old-time method of drilling a through bore.

The barrels here described are supposed to have been taken from rolled or hammered bar steel. Should they be forged or rolled in separate lengths, or if there is to be other than a plain front sight, or should a bayonet stud be added, more apparatus would be required than that here noted.

The total number of operations on a military rifle barrel is thirty-two. It is first cut to length from the bar in a

CUTTING-OFF LATHE.

This machine requires no description, as it is the familiar machine now used for cutting off stock in most machine shops. They are next straightened, if required, by hand with hammer and anvil, and are then turned at both ends of barrel to fit the collets of the boring machine.

This machine turns both ends of a barrel at one setting. It has a hollow spindle carrying a chuck at each end to grip the stock to be turned as near as possible to the end of the required cut. Mounted on the bed of the machine at both ends are turret heads, carrying cutting tools for rough and finish turning. One turret is so arranged that the stock for the barrel can be passed directly through it, and also through the hollow spindle, to a stop in the opposite turret. Thus, after being secured in both chucks, both ends of the barrel can be accurately turned. This method eliminates the centering of the stock at both ends, and it should be noted that accuracy in turning to exact size largely insures good drilling of the bore.

After this the barrel is ready for the fourth operation, which is the drilling of the through bore.

BARREL DRILLING.

The barrel-drilling machine is shown at Fig. 1, and is, in fact, two independent machines, both supported on one horizontal bed, to which at one end are attached the heads. Mounted in them are two rotary (belt-driven) spindles, having on their inner ends chucks for gripping at one end, and rotating the barrel while being drilled. The other end of the barrel is supported and controlled by and revolved in a central rest that can be adjusted and secured at will, for the purpose of placing and removing the barrels. These rests also support the die that guides and controls the drill at the start. A sliding carriage having ample traverse, driven by screw feed that can be varied through change gearing, supports and secures the hollow shank of the drill in such manner that it matches the piping from the rotary pumps that supply a continuous stream of oil under the required pressure; thus the cutting lip of the drill is lubricated, the chip driven out and the oil returned to the tank, strained and in such condition that it can be used for months. One of the important features of this machine is the method of rotating the spindle, which has mounted on and driven with it an adjustable screw collar and spiral tension spring, one end of which presses against the collar, the other against the hub of the driving pulley; thereby the driving power can be adjusted and made less than the torsional strength of a drill, and thus the breakages are avoided when anything goes wrong.

The speed of the spindle for a .30-inch caliber drill is from 1,200 to 1,600 per minute, according to density of stock, and the feed per revolution from .0002 to .0004 inch.

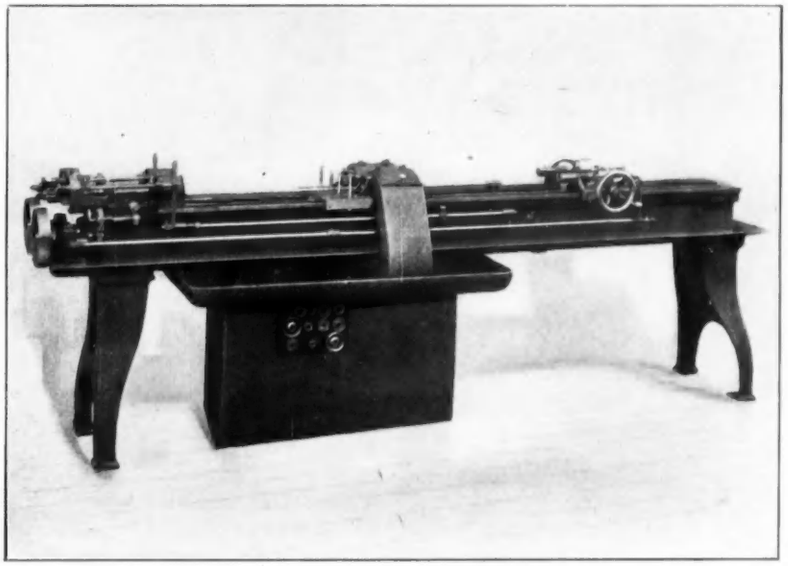


FIG. 1. BARREL DRILLING MACHINE.

The machine as arranged has every appliance to make it easy of manipulation; and therefore only ordinary mechanical skill is required of the attendant.

For drilling the barrel a one-lip pod drill is used having a small aperture drilled the entire length of its body—about 4 inches long, exclusive of the shank (Fig. 2). One end of the aforesaid aperture terminates near the cutting lip of the drill; the other end leads through the shank, which is fitted into and secured to a tube that is long enough to reach through the entire length of a barrel. The tube is slightly smaller than the drill, and has a groove corresponding in size to the pod of the same its entire length. Thus, there is a continuous pod to the drill, and also an aperture from its cutting lip through the inside of the tube. Oil, when forced by high pressure into and through the drill, stiffens the tube, lubricates the cut-

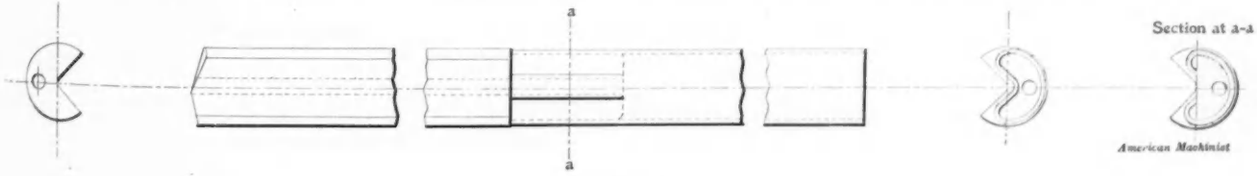


Fig. 2

DRILL BIT AND SHANK, ENLARGED VIEW.

ting edge, drives the chips out through the pod, and also carries off the heat generated by the high cutting speed. It should be stated that it was through the efforts of Mr. J. Worth Hyer (a contractor at the Pratt & Whitney works) that the improved method of drill making for small bores has attained to such a degree of perfection.

After drilling, the fifth operation is that of

STRAIGHTENING THE BORE FROM SHADE LINES.

This is an art which has been handed down from generation to generation, and can be acquired only by practice under skilled tuition. The apparatus required is of simple character. There is a frame piece of flat ground glass about 15 inches square, having a painted, black, horizontal line near the middle. It is placed about 7 feet from the floor and about 30 feet from the operator. The anvil on which a barrel is to be straightened has let into its face two blocks of steel that project upward about 1 inch, and are located crosswise at an angle to each other, thus affording different spaces for long or short bends. Steel hammers are used for rough and wood mallets for finish straightening. An adjustable forked rest is provided to support the barrel in proper position to suit the eye of the operator, who stands upright and places one end of the barrel in the rest, usually grasping the other with both hands, when he sights through the bore directly to the horizontal black line on the glass, so that when the light shines through the glass two dark lines will be sharply defined about three-fourths the length of the bore. Should the shade lines show curved or irregular, the barrel is crooked. The operator slowly revolves the barrel to determine this matter. If curves show, he turns the barrel around until the lines bow upward, marks as nearly as possible the uppermost part of the curve, removes the barrel to the anvil, placing it in such position as in his judgment the length of curve demands, then delivers his blow with the hammer on the top over the curved portion, thus driving it down, beginning in the middle; repeats the operation of sighting and hammering, changing ends of barrel that all parts of the bore may be examined. As was said at the beginning, straightening is an art, and he who masters it can do so only by long-continued practice.

AN OLD METHOD OF TESTING BORES.

Probably the oldest method (said to be Russian) of testing the bores of musket barrels, is by a line. One end of a fine silk line somewhat longer than the barrel is attached to one end of a bow (strung something like an archer's). At the other end of the line is made fast a small leaden bullet. This is dropped through the bore, carrying with it the line. The bow is then strung in such a manner as will keep the line taut. Then the barrel is placed in a rest, in such position that strong light will shine through it. Sighting through the bore, if a continuous black line does not show, the barrel is either crooked or has not a parallel bore. By rotating the barrel, all parts of the bore can be examined. If the silk line does not come in contact with the surface, light will show underneath, thus leaving it almost colorless. Where there is contact it will be black. The method of straightening is the same as that heretofore described.

After straightening, the barrel is reamed, leaving a small amount for finish. The machine for this, represented in Fig. 3, is of recent design. It consists of a bed on which at one end is attached the head in which is mounted and geared together and supported by two sleeved journal boxes, the two spindles having chucks for carrying the reaming tool. Also on these spindles between the bearings are splined on two clutches, which engage through lever action the pins in the two gears which are mounted and run loose on the inner ends of the before mentioned sleeved journal boxes. The two gears are driven by one pinion gear attached to a shaft, also in a sleeve journal, which has on its outer end a three-step cone pulley. Also mounted on the bed of the machine are two independent sliding carriages having ample traverse, that through change of gearing can be fed at different rates of speed in either direction, and stopped at either end, or in any part of the travel, or they reverse automatically. They can also, when disengaged from feed gearing, be controlled by the hand wheels.

Attached near one end of guide-way of top of sliding carriage is mounted a movable fixture, having a swivel clamp and

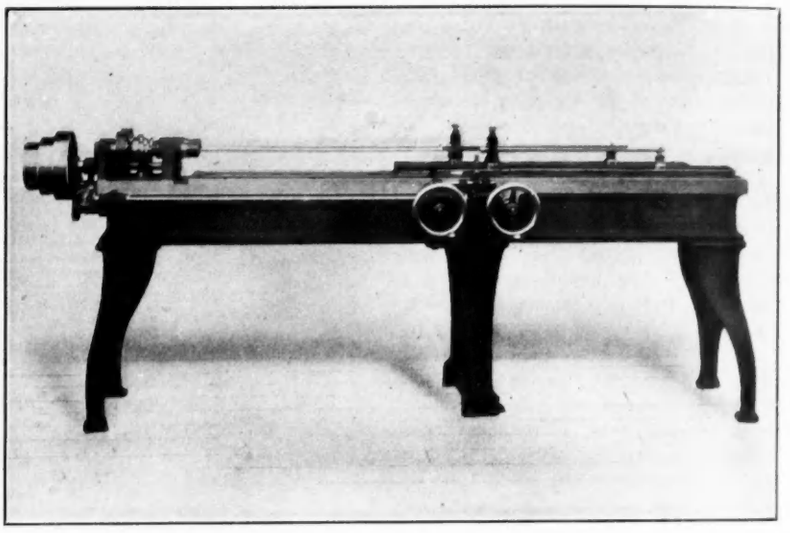


FIG. 3. TWO-SPINDLE REAMING MACHINE.

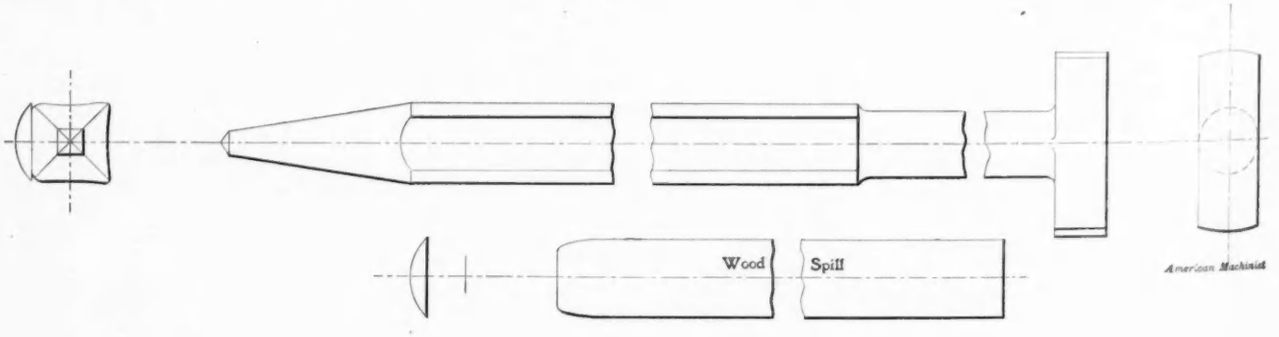


Fig. 4

FINISH REAMER, ENLARGED VIEWS.

hand screw for holding one end of a barrel, which is supported at the other on an adjustable stand, which may also be moved lengthwise.

The stopping and starting of the machine is done through the foot pedals that are connected to lever action which controls the clutches on the spindle, therefore leaving both hands of the operator free.

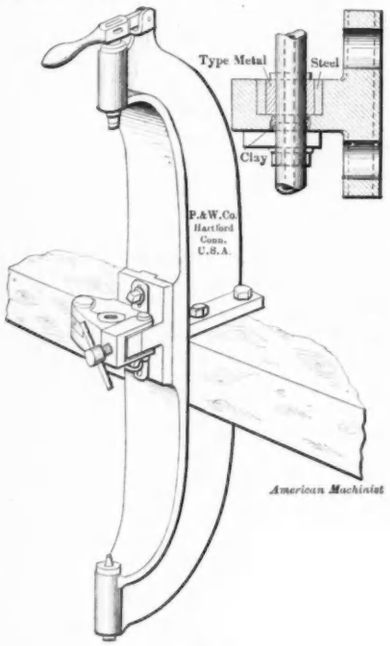


Fig. 5

FIXTURE FOR CASTING ON RING BEARING.

The speed of reamers for .30-inch caliber should be about 75 revolutions per minute. Travel of table 10 inches per minute.

TOOL FOR FINISH REAMING.

For many years the finish reaming of gun and rifle barrels has been a matter that largely engrossed the attention of many skilled gun makers. Various reamers have been tried with little success. It is now generally conceded that the old square reamer, with soft wood back (English name is "spill"), is about the only one that will do satisfactory work (in the hands of skilled workmen) every time. The square reamer has a shank, which may be welded on if desired, long enough to reach through a barrel. The parallel cutting edges of the pointed bit are about 12 inches long. Three sides of the bit are ground slightly concave, that the stoning or sharpening may be made easier. Opposite (back side) of the cutting edges both corners are slightly rounded. A piece of soft wood about 12 inches long, flat on one side, rounded the radius of bore to be produced on the other, and thinned down almost sharp at each end, is placed on the back side of the bit and secured by a ferrule or ring being slipped over it from the shank. When the reamer is fed into the barrel the ring is pushed back. The method of increasing the size of bore is by packing under the wood with thin pieces of paper.

BARREL TURNING.

The seventh operation consists of casting on to the barrel a steel ring, or collar, which serves as a bearing for the center rest in turning the outside.

A steel ring about 1.75 inches in diameter, .60 inch face, with bore large enough to pass over the rough barrel, leaving small space all around for the type metal, is used.

For this work an upright fixture (bolted to a bench) is arranged to support and control the barrel at the lower end on a fixed plug-center fitting the bore; the upper end in the same manner, except the plug-center can be raised or lowered by a hand lever. Midway of the upright frame is secured an adjustable head having two parts, the front or outer portion being hinged in such manner that it can be swung outward after being released by the hand screw in the movable clevis. In the before-mentioned head is a cupped recess, or pocket, of the proper diameter to receive and hold the ring bearing concentric with the barrel supports.

After the barrel and ring are secured, clay is used under the head to prevent the molten type metal from escaping. Only a small melting furnace is required, as the space to be filled between the barrel and ring bearing is very small.

The method of turning barrels here described is one devised at the British National Armory, Enfield, England, and to a Mr. Perry (now deceased) belongs the credit of the invention. His system (section turning for removing rough stock) does away with the huge grind-stones formerly used to reduce and shape the outside of barrels.

The beginning of the Perry system is that of casting on the collar bearing for the center rest. The machines for turning differ little in general plan from those heretofore used (belt-driven, graded speed and feed engine lathes), except in arrangement of carriages for mounting the several turning tools. It will be obvious to those skilled in the art of turning that the central collar bearing holds the bore of barrel concentric and keeps it from springing when the two spot bearings are being turned with two tools. Also when supported in two center rests and the three sections are being turned with three tools that are fed together at one time. Therefore it can be seen that time is saved, and a less number of machines required than by the older system.

The first turning operation is to turn two places to suit center rests. For this a lathe is used having one compensating center rest and the carriage arranged to carry two turning tools mounted in such manner that they have independent lateral movement for the purpose of being adjusted. The former at the back side controls the profile of the barrel. The lathe has all requisite appliances; graded speed and feed also can be arranged for, and there are water conductors, pumps and chip pans. It will be noted that after the spot bearings are turned, the remaining rough stock is in three equal divisions.

The collar bearing is now knocked off by hand, and the tenth operation is to turn

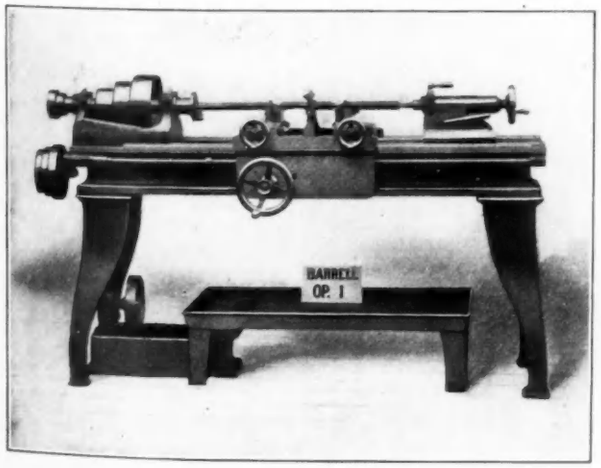


FIG. 6. LATHE FOR TURNING SPOT BEARINGS FOR CENTER RESTS.

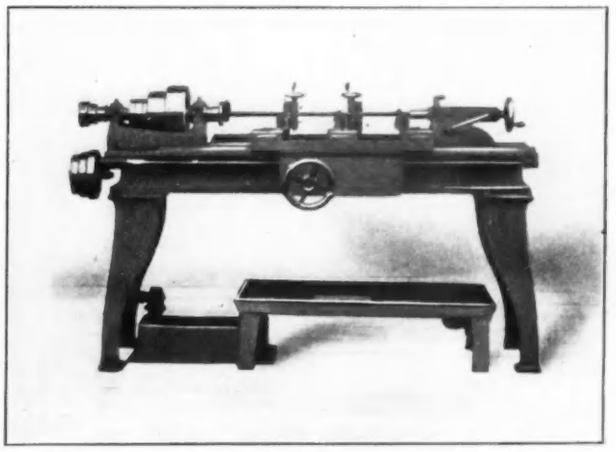


FIG. 7. LATHE FOR BARREL TURNING CARRYING THREE TOOLS.

these three parts. For this a lathe having carriage with three tools and two compensating center rests is used. In other partiuclars it is the same as the lathe used in the eighth operation. It will be noted that one turning tool begins its cut at the muzzle end; the other two at the spot bearings. There is space enough beyond the spot bearings to allow the tool to have free entrance on its cut.

The next operation is to face the breech

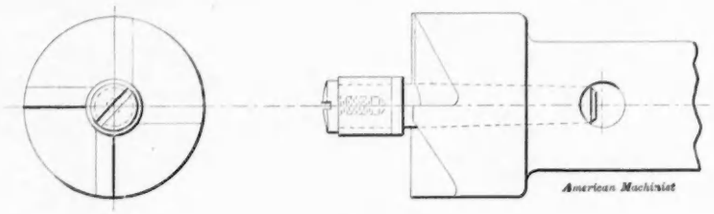


Fig. 8

TOOL FOR FACING END OF BARREL.

end of the barrel, which is done in a hand lathe having a hand lever attachment to the tail spindle. This machine needs no description, other than to state it is rigid and provided with suitable stops as nearly as may be positive. The cutting tools are in the form of a counterbore. Inserted pivots make the tools easy to keep in good condition, for they should be so kept to insure an accurate face at the breech end of the barrel, because from it all outside gaging commences.

For the twelfth operation the barrel is finish turned the whole length. This is done by a continuous cut of a single turning tool, and the lathe used is the same as those used for the previous turning operations, except that no center rests are used and it has two forming guides, one for governing the cut of the turning tool, the other for controlling the follow rest support, which has a right-angle notch; thus two lines of control are had while the barrel is being turned.

The barrel is then again straightened, if required, in the same manner as before.

And the fourteenth operation is to

POLISH OUTSIDE OF BARREL.

The barrel-polishing machine for handling five barrels is of late design, light and compact. It occupies little space as compared with the older style, and is a radical departure from the ponderous apparatus heretofore used for polishing the outside of the rifle barrels.

Its salient feature is the construction of the upright frame, so braced and stayed that it withstands the shock consequent on long crank action.

To a suitable bed is bolted the pillar block frame having substantial journal bearings, in which is mounted the main shaft. On this are 7-inch face, 32-inch diameter (tight and loose), driving pulleys; also the counterbalanced crank disk, carring a crank pin which can be adjusted from 16 inches to 32 inches stroke. Bolted and staybolted to the bed are vertical uprights having adjustable guides, in which is (driven by connecting rod from crank pin) the vertical reciprocating carriage, in which are (mounted in journal boxes) the five geared-together rotating spindles, whose motion may be continuous or made intermittent by action of a hand lever. The spindles project below the carriage to receive chucks for holding the breech ends of the barrels; also bolted to the bed at the front is a stand having at the bottom a suitable drip pan. At the top are hinged, facing each other and in center line with spindles, five pairs of arms, which may be simultaneously opened, and held open, by hand lever action, and closed by connecting springs. At the upper ends of these arms are mortise pockets, into which are inserted and held fast by set screws ten adjustable wood polishing blocks, which hold oil and emery, and thereby polish the barrels as they are driven up and down between them under spring pressure.

The fifteenth operation is to mill the recess for the front sight, and this is done in a hand milling machine of the familiar knee type, the end of the barrel being held in the ordinary milling machine vise provided with suitable jaws.

The front sight is then brazed on with a compound blow pipe, using gas and compressed air, and then the sides and top of front sight mass are milled to shape in a plain milling machine with power feed and automatic knock-off.

The eighteenth operation is to finish ream, using the same machine as previously described. This operation can be dispensed with and the barrel reamed to the finish size at first if care enough be taken in brazing on sight mass so that no scale be raised in the bore.

The saw cut for the front sight is then milled through the sight mass, and for this a small hand milling machine is used, after which that part of the barrel that is to be threaded is turned in an ordinary lathe.

The twenty-first operation is

RIFLING THE BARREL.

Rifling machines have undergone many changes because of the sharp spirals required in the small bore. Old-style rifling seldom demanded less than 20 inches to

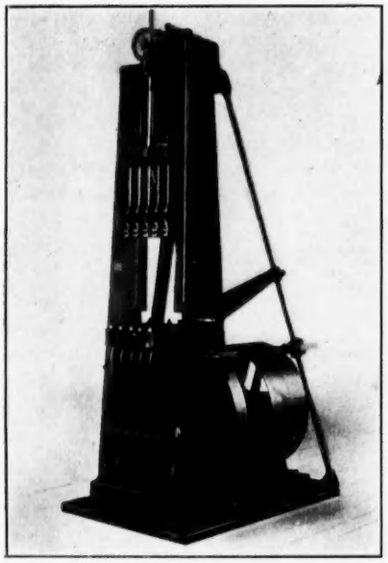


FIG. 9. BARREL POLISHING MACHINE.

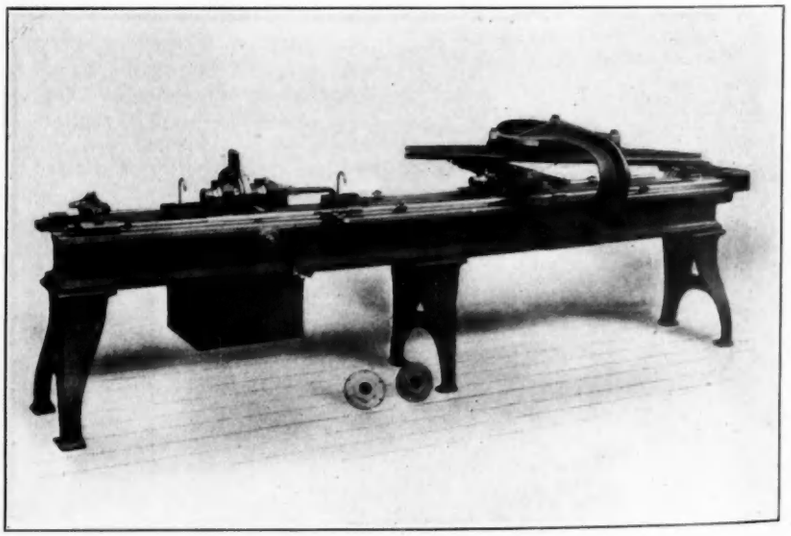


FIG. 10. RIFLE BARREL RIFLING MACHINE.

one turn; now less than 7 inches is at times required.

The machine consists of a bed carrying a head for holding and indexing the barrel, and a carriage having a spindle for holding the rifling rod, and all the appliances necessary to control its motion and feed the cutters automatically.

The head has a spindle which holds the barrel by means of a convenient chuck, and is provided with an indexing arrangement by which it is automatically turned at the end of each stroke of the rifling rod through the proper angle to give the required number of grooves.

The carriage has a spindle for holding the rifling rod, on which is a pinion meshing with a rack on the carriage cross-slide. The carriage is given a reciprocating motion by means of an ordinary open and crossed belt-reversing mechanism, which is operated by dogs on the carriage at the ends of its stroke. The rifling bar controls the twist of the rifling, and is placed above the carriage, and connected with the carriage cross-slide by means of a swiveled slide. It is pivoted at its central point so it can be set at any angle, and as the carriage moves along the bed a transverse motion is imparted to the carriage cross-slide. This causes the spindle to turn as it advances, so that the rifling cutter describes a true helix. If an increasing twist is required, the rifling bar must be formed to suit the curve of the rifling, the ordinates of the curve of the rifling bar being in the same proportion to the ordinates of the developed curve of the rifling as the pitch diameter of the spindle pinion is to the bore of the gun.

The rifling rod is provided with one or more cutters, which are fed out by means of a wedge-shaped plunger, which extends beyond the end of the rod, and is driven in at the end of the stroke by an automatic feeding device. This is arranged so that the feed is always alike, whatever the variation in the travel of the carriage, and stops when the cut has reached the proper depth. The rifling bar being set at the proper angle, and all the dogs and stop nuts being adjusted, the barrel is placed in the head, and the machine started by a lever placed at a point on the bed where the operator can observe all the motions of the machine. After starting, the carriage continues its reciprocating motion, the head indexes the barrel at the end of each stroke, and the cutters are fed until the grooves have reached the proper depth; when the feed stops, the machine is stopped by the operator, and a fresh barrel is put in place.

An oil pump floods the cutter with oil at each end of the stroke.

The machine is arranged for four, five and six grooves of uniform twist, from straight to one turn in 5 inches, either right or left hand, but can be built for any number of grooves, and for an increasing twist of any desired curve. The cutting speed for ordinary steel is 30 feet per minute, and is uniform throughout the stroke.

RIFLING ROD.

A rifling rod has six distinct parts—head, feeding bar, cutters, rod and rod shank; also two pins for securing the head, rod and shank.

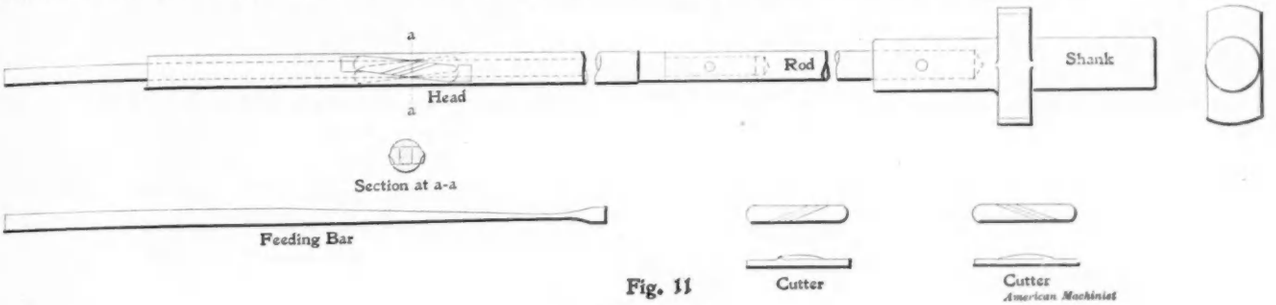


Fig. 11

THE RIFLING ROD.

The head here shown (Fig. 11) was designed for cutting six grooves in .30-inch caliber, one turn in rifling in 9.5 inches. The cylindrical head, exclusive of a shank 1 inch by .20 inch, is 9 inches long, and of such diameter as will pass easily through the barrel. From the outer end is a central bore of .14 inch diameter, 5.5 inches deep, into which, 2 inches from the end and directly opposite each other, are cut (milled) two pockets 1 inch long, laid at

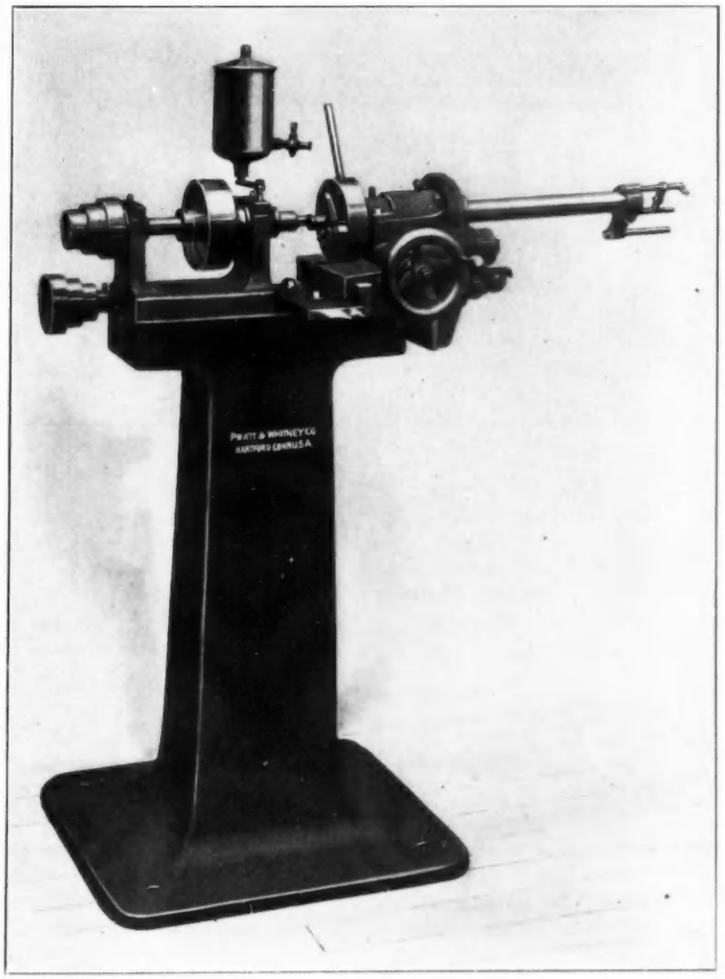


FIG. 12. BARREL THREADING MACHINE.

the angle of the spiral, and having a width to equal the groove to be cut.

The feeding bar (.14 inch in diameter and 6 inches long) has, opposite each other, two flattened inclines 2 feet long, thus forming a wedge, the point of same beginning ½ inch from the end of the bar, which, when placed in the bore of the head and under the pockets, forms the bed or seat on which the rifling cutters rest.

There are two rifling cutters, the length and width the same as the pockets in the head. On their outer faces is formed one angular tooth, so shaped as will give the required form at the bottom of the groove. Their inner faces are flat and tapered to suit the inclined surface of the feed bar, by which they are forced outward and expanded to the required depth of the rifling.

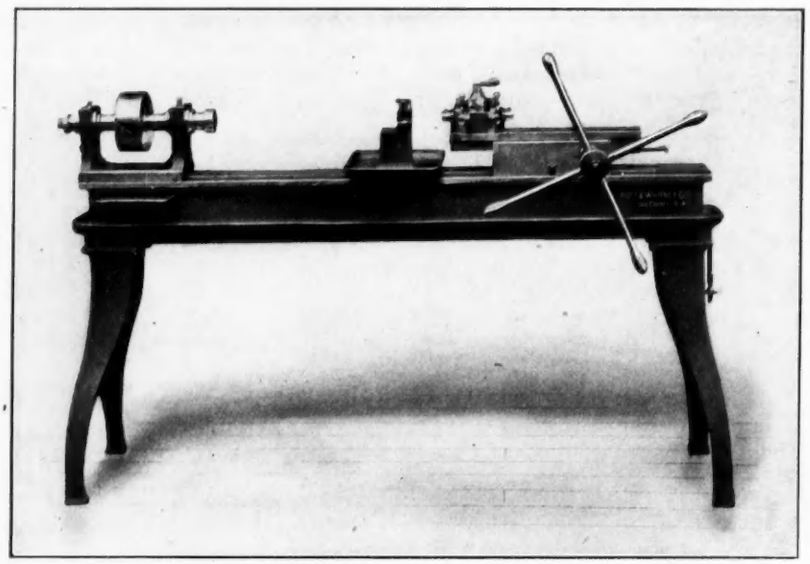


FIG. 13. CHAMBERING MACHINE.

The rod is long enough to reach through the barrel and of less diameter than the rifling head, whose shank enters into the socket, 1 inch by .20 inch in diameter, made at one end. The parts are secured by a small taper pin riveted.

The rod shank is 2.75 inches long; the body is .50 inch diameter. Midway extend two ears .30 inch high, .50 inch wide and .30 inch thick. At one end is a socket 1 inch deep, and of such diameter as will receive the full diameter of the rod, which is pinned and riveted fast with rod shank. The before-mentioned ears interlock with the spindle of the rifling machine in such manner that the complete rifling rod can be removed and replaced with certainty of no displacement, either circular or lengthwise.

The hook cutter for rifling small arms has been used to a considerable extent for large bores, and does very satisfactory work, though a dangerous tool in other hands than those of an expert. For very small bore the hook and its mechanism are quite too delicate, and therefore it has been abandoned by nearly all gun makers.

The twenty-second operation is to cut the screw thread on the barrel. The machine for doing this is shown in Fig. 12, and is of late design. The thread is cut by a rotary cutter driven by a belted pulley on the spindle of the usual form. The barrel is supported and controlled in a horizontal, hollow, rotating spindle having a master screw, from which, by gearing, the required pitch of thread is milled while the barrel is being revolved against the rotary cutter. Embodied in the machine are all required stop attachments for gaging depth and length of screw thread.

Next, the barrel is chambered for the cartridge. For this is used the chambering machine (Fig. 13) with turret carrying six tools mounted on a slide of ample traverse, actuated by rack and pinion movement, controlled by a spoke wheel in the hands of the operator. On the rotating spindle of the machine is mounted a chuck or collet, in which is placed and secured the muzzle of the barrel. The breech end is supported in the center rest, so arranged that the upper portion can, after being unlocked, be raised on the hinge joint for the purpose of placing and removing the barrel.

The driving pulley on this machine should be so arranged by a friction device that the belt drive would yield before the breaking point of the chamber reamer is reached.

The chambering reamers, as shown in Fig. 14, are three in number—roughing, half finish and finish. The two last mentioned are made alike, with the exception of slight differences in diameters. That for roughing is made in such a manner as to form a series of independent end cuts, therefore breaking up the chips and creating less friction than full-length chip of finish reamers. All have mounted on them rolls that pass easily into the bore of barrel by which they are guided during the cutting operation. The shank ends of the reamers are provided with adjustable screw-stop collars which abut against the barrel end. The collets in the turret head are so arranged that the reamers are not arbitrarily controlled except from rotating. They can yield to accommodate any small eccentricity of bore, and the method of doing this is shown in Fig. 15.

The next operation is to drill and ream the hole for the front sight, and this is done in a sensitive drilling machine. Next, two holes are drilled for rear sight screws. These are tapped in a vertical tapping machine, after which the barrel is milled at the breech for the extractor in a hand milling machine, and the barrel is then hand finished the whole length. The muzzle is then finished to shape in a hand lathe, and the barrel is ready for browning.

BROWNING GUN PARTS.

Browning is but a film or oxide formed on the surface of metal by corrosion. The formula here given for acids and proportions of same, when properly applied, gives very satisfactory results for military purposes.

Formula for Browning Mixture.—Corrosive sublimate crystals, 1 oz.; nitric acid, 1 oz.; tincture of steel, 1 oz.; spirits nitre, 4 oz.; pure water, 4½ pints. Should be used soon after being mixed. A suitable sized tank so arranged that it can be filled with water and the same drawn out when desired. It is also fitted with steam piping (coil preferred) in such manner that live steam can be introduced for the purpose of boiling the water.

OPERATION.

First—Thoroughly clean the parts to be browned from all grease. Mix lime and water to a consistency that may be spread with a brush.

Second—When dry, remove all dust with a brush.

Third—Apply the browning mixture with a sponge. When dry, apply another coat. Leave for 12 hours to form a coat of rust.

Fourth—Place the parts in a tank and cover with water. Turn on live steam and boil slowly for 20 minutes.

Fifth—Draw off the water; remove the parts from the tank; allow them to cool to about 70 degrees Fahr. Then scratch lightly with a wire brush (card cloth). Care should be taken not to scratch too hard. After thorough scratching, apply another double coat of mixture, same as first, and repeat the boiling and scratching until a hard coating of rust is formed. After completing the boiling and scratching process, apply while quite warm a coating of beeswax cut with turpentine. Then rub off the parts. Oil is commonly used for this purpose. Usually four days is about the time allowed in which to complete the process. The state of the atmosphere largely controls the forming of rust; therefore comes in a matter of judg-

ment obtained only by practical experience. The other main feature is that of keeping all oil or grease, even the naked hands, from contact with parts until after the browning is complete. After this the muzzle is polished in a hand lathe head, and the final operation is to inspect the bore and gage the rifling.

INSPECTION.

About 1880 a very ingenious apparatus was designed and used at Enfield, England, for the inspection of the Martini Henry rifle barrels. It was constructed as follows: A substantial framework about 6 feet in hight. Near the top was placed in such manner that it could be adjusted and secured at a convenient angle, a frame about 15 inches wide and 20 inches long. On the top at each end were placed bearings which supported two small spindles on shafts (placed parallel to each other), having mounted near each end two rolls about 2 inches in diameter, ½-inch face (four rolls in all). They were located so as to run as nearly as could be without touching each other. The beforementioned spindles were power driven at a very slow speed (tape belts), and in the same direction. The barrel to be inspected was placed on the faces between the revolving rolls, which being of larger diameter than the barrel formed four friction supports, thus revolving the barrel at the same speed at the faces of the rolls. The method of using the apparatus was to range through the bore of the barrel at the horizontal black line in such manner as heretofore described in shade-line straightening. By this method all parts of the bore could be examined, particularly the imperfections in rifling, eccentricity of bore, also chambers, as different speed could be obtained when at slow speed, and by touch the barrel could be dead-stopped.

My thanks are due to the Pratt & Whitney Company for courtesies shown me in connection with the preparation of this article.

Electric Pivoted 150-Ton Derrick.

In Bremerhaven, Germany, at the mouth of the Weser, has recently been erected a 150-ton electric pivoted derrick, which is the subject of a leading illustrated article in "Le Génie Civil." It is of T-shape, the fixed portion being an open steel structure reaching up to the elbows of the T, while the movable portion consists of a truss forming the arms, with a stem or core reaching to the ground and revolving inside of the fixed support. The bearings of the rotating portion are at the top and bottom of the support. The derrick is made to rotate by means of an electric motor, 26 horse-power, running at 550 revolutions per minute through the medium of an endless screw and three pairs of gears, by which the speed is so reduced that the derrick requires 7.2 minutes to make one complete turn. An electric carriage travels along one arm of the T, and at the end of the other there is a counterweight. The derrick is 118 feet high. It was built by the Benrather Maschinenfabrik, of Benrath, near Düsseldorf.

A Water Motor Pump.

The interesting pump shown externally by the half-tone Fig. 1, and in section in Fig. 2, is of a class for which there is now quite an extensive field of special employment. The pump is operated by water pressure, the liquid operated upon by the pump being either water at some other pressure, clean water or hot water, while that in the motor is impure and cold, or some liquid other than pure water, as in chemical works, refineries, distilleries, or breweries. Where there is a water supply with a good head, as in most cities, the water may be used to drive this pump and still be serviceable for washing, boiler feeding, or other general service.

In the pump here shown the lower cylinder is the pump, which requires no explanation, and the upper cylinder is the motor. The pistons in both cylinders are attached to the same rod, have the same stroke and always travel together.

The interesting feature of the present motor is in the valve movement. Valves operated by water pressure are more likely to come to "dead" positions that will allow the motor to stop working than when operated by steam or compressed air, where the elasticity of the operating fluid

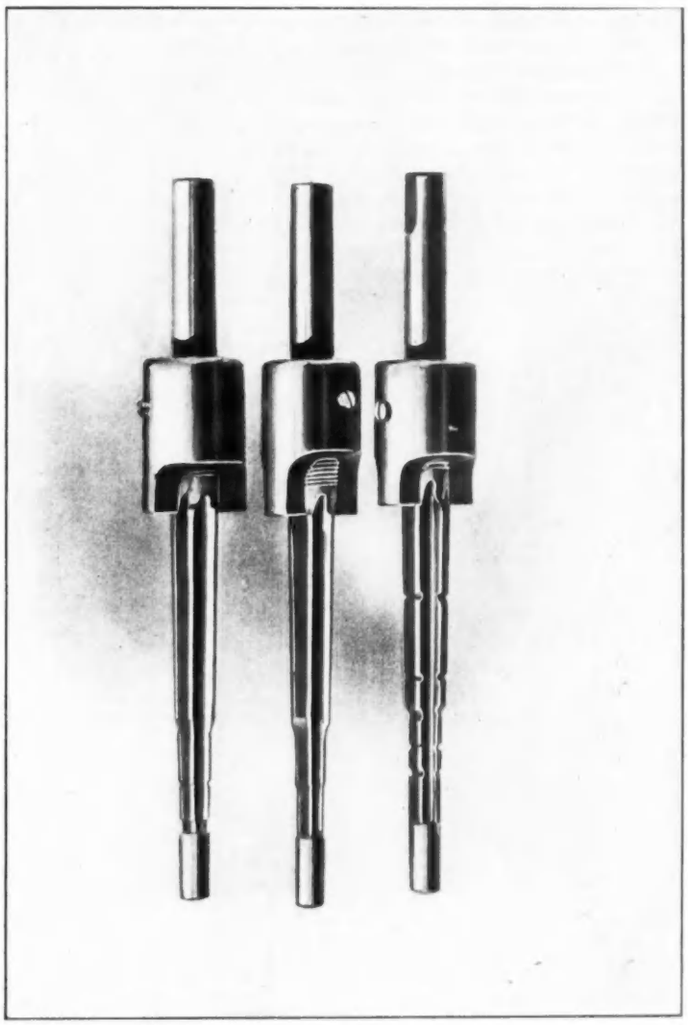


FIG. 14. CHAMBERING REAMER.

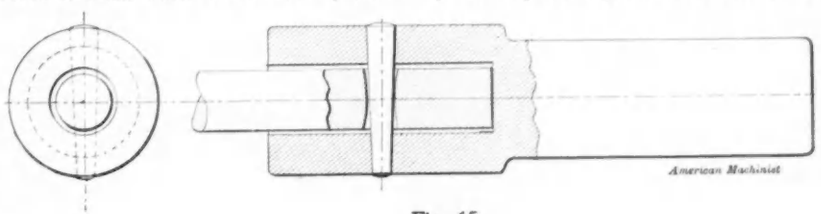


Fig. 15

COLLET FOR CHAMBERING TOOL.

gives life to the stroke. In this motor it is claimed, as seems to be the fact, that a reliable valve movement has been secured by simple means.

The rock shaft at the top of the pump has a lever on each end of it, one of the levers being attached by a long connection to the piston, or, rather, down in the hollow piston rod of the motor, and the other arm being connected to the valve rod. These rock shaft levers are parallel, and project in the same direction, but that attached to the motor piston is much longer than the one that operates the valve rod, so that while the rod always moves when the piston moves, and in the same direction, its travel is not more than, say, a quarter that of the piston. What we are

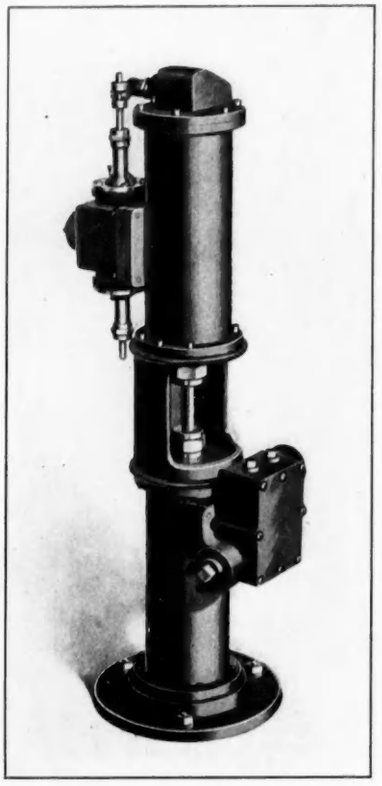


FIG. 1. A WATER MOTOR PUMP.

calling the valve rod is not in fact a valve rod, and is not attached to any valve but itself. It is in itself the primary valve. It slides freely through the large piston valve. which is the main valve of the motor, this valve being moved entirely by the alternate transfers of the liquid pressure from one end of it to the other. The valve rod, then, or the primary valve, is a tube of uniform external diameter, with a tight partition inside the tube at the central position indicated, the ends also of the tube being closed, thus forming two tubular chambers, one of which, by a hole in the side, is always in communication with the enclosed space above the main valve, while the other chamber is always in communication, by a similar hole at the side, with the enclosed space below the main valve. Near the lower end of the upper chamber of the primary valve, Fig. 2, are seen several small holes in communication with the upper or pressure space of the main valve. As this upper space of the main valve is in connection with the operating pressure supply the space above the main valve is subject to the same pressure, which accounts for the

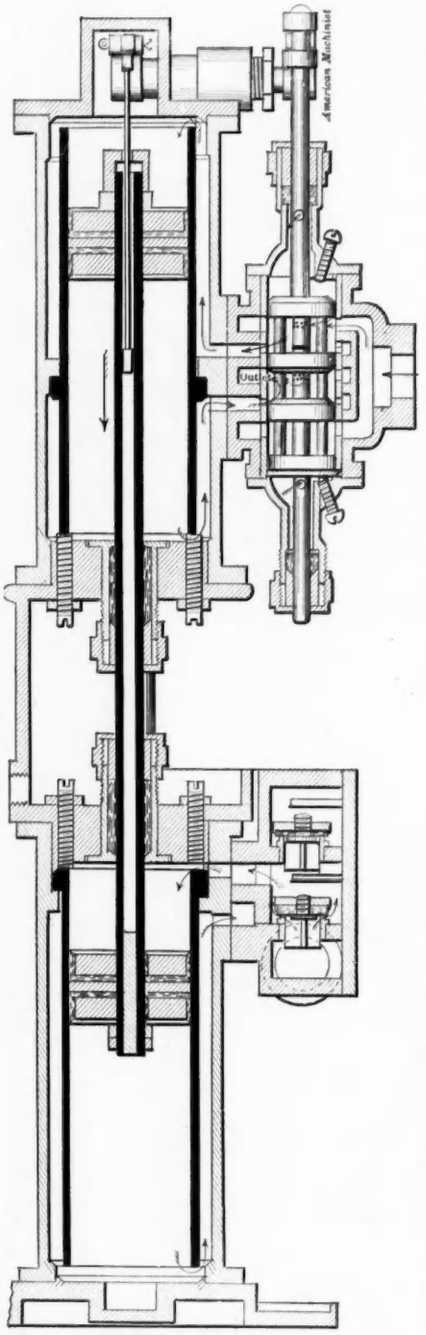


FIG. 2. SECTION OF WATER MOTOR PUMP.

position of the valve at the lower point of its travel. At the same time it will be noticed that the small holes of the lower chamber of the primary valve are in communication with the central or exhaust space of the main valve, thus at the same time putting the space below the main valve in communication with the exhaust, as indicated by the arrows. In the position shown in Fig. 2 the pistons of motor and pump and the primary valve are all descending, while the main valve is stationary. This will continue until the small holes of the upper chamber of the primary valve come in communication with the exhaust space of the main valve, while the small holes of the lower chamber of the primary valve come in communication with the pressure space of the main valve. When this occurs the pressure and the exhaust are both transferred to the opposite ends of the main valve, it immediately rises to its upper position and the stroke of the motor is reversed. It will be noticed that as soon as the small holes are in the least uncovered in the position for the main valve movement to occur, the continued travel of the motor piston and the beginning of movement of the main valve both operate to completely open the communication, and no stalling of the pump is possible. The travel of the main valve is limited and adjusted by the screws seen at each end of the chest. The valve movement is thus seen to be extremely simple, little liable to derangement and not readily yielding to the tampering of unskilled and inexperienced persons who may have to do with it. These pumps are made in various sizes and with different ratios of cylinders, as may be required. The pump is also used as an air compressor, and especially for blowing organs in churches or elsewhere. It is built by the L. E. Rhodes Company, Hartford, Conn.

Making Follow Boards.

BY L. C. JEWETT.

Among the many conveniences required by the molder, particularly the bench molder, to economize and expedite his labors, follow or match boards perform an important part, and especially so in these days with solid patterns with few, if any, loose parts. Patterns, however crooked the lines of the joint may be, can be molded without a follow board, and where there are but two or three castings required from the pattern, follow boards would not be economy, as they require both time and material. Large work of any kind made on side or crane floors, or bedded in flasks or floor-pit, large gears above 18 inches in diameter, spur or bevel, do not require a follow board, and on any pattern that is bedded in it could not be used.

Follow boards are made of various substances, depending on the service required, as well as the nicety and the weight. The latter becomes a noticeable matter where the board is used many times in a day. The first operation in making a follow board is to place the pattern in the nowel part of the flask and in the position wanted, right hight, desired slant, etc. Make a joint where a joint line is required on the pattern, using the same care as if a cope was to be rammed upon it.

Have the joint of even firmness. In many cases it is a good practice to rap and withdraw the pattern to see if the joint is all right. When repairs are made, if required, return the pattern to its place. If it is desired to make the follow board of plaster of Paris, it will be necessary to coat the pattern with some oily or greasy substance where contact with the liquid plaster is to occur. Crude petroleum, strong soapsuds, vaseline thinned with kerosene, and applied with brush or fingers, are among the best articles used. Give the nowel joint a dusting of plumbago.

The carpenter should make a frame the same size as the flask, of 2 or 1½-inch stock and as shallow as possible. Where necessary, projections of the pattern could be let into or through the bottom board. The frame should be attached to the bottom board with nails projecting inward from the board and edges of the frame, to hold the plaster in place when it becomes dry. In many cases parts of the frame can be blocked off or filled with wood to lessen the weight. Holes 2 inches diameter should be bored through the bottom board for pouring the liquid plaster. Some boards, where the top is level, are poured with the bottom board off. The board with frame attached is placed on the nowel and clamped or weighted, the latter way being less liable to warp frame or nowel. See that the joint and all openings are tightly calked with wet sand. Place good large cups or sand runners around the pouring holes, and then prepare the plaster to pour.

To add water to the plaster is not as good as to add the plaster to the water. Get the water in a circular motion before adding the plaster; keep stirring and keep the plaster going into the water (do not have lumps), until it comes to the consistency of thick cream, and pour at once. Stay by it when filled, with a little more plaster to keep the heads of the openings up. As the water percolates through the sand, the pouring hole or holes will shrink down, hence the touching up. The addition of salt to the water renders the plaster firmer when dry. Thirty to sixty minutes, according to the character of the follow board, should pass, after pouring, before rolling over. Remove the nowel and the sand from the plaster joint. Rap the pattern gently and remove. Dont wait too long, as plaster shrinks as it dries, requiring considerable cutting and relieving to have the pattern go easily into place. Do not wash with water and brush, but brush when dry.

Blocks of plaster of Paris are used to form the joint between oval arms in patterns of wheels, gears, pulleys, etc., or to place under parts and projections of patterns to bring the joint in proper place and shape for the cope to be rammed upon. (See Figs. 1 and 2.)

For litharge-sand follow boards, first mix litharge with boiled linseed oil—two or three tablespoonfuls of litharge to a pint of oil. Oil may be used without the litharge, but it gets dry and firm in less time with the litharge in it. Take of dry sand (new molding sand is preferable, but fine burnt core sand works well or burnt molding sand), dampen or temper the sand with the boiled oil to a good damp condition. Riddle this tempered sand through a No. 4 or 6 sieve, to thoroughly mix and incorporate; be sure and clean the sieve while it is still damp. The nowel having been prepared the same as for a plaster board, with the exception of oiling the pattern, place the frame upon the nowel joint and proceed to tuck in thoroughly into every portion of the pattern the prepared oil-tempered sand. With fingers and hand put on a surplus of the

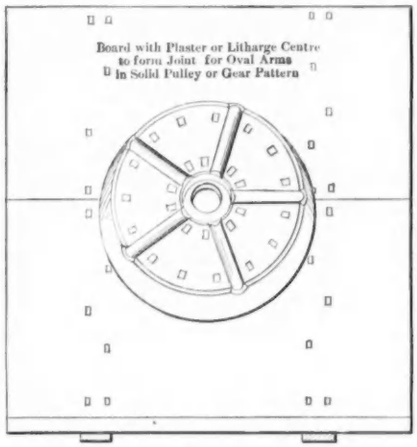


Fig. 1

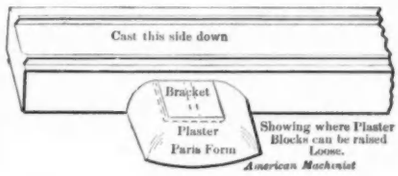


Fig. 2

MAKING FOLLOW BOARDS.

mixture, finishing with a gentle but thorough ramming with the butt of a hand rammer. Strike off, and put on the bottom board, thoroughly rubbed on, and securely nailed to the frame. Turn over nowel and follow board, removing nowel and sand. If it is required to be secured with nails to the board this is best done before the pattern is withdrawn. When finished, place on top or in the bottom of the core oven, where it will not get too much heat. It will require from eight to twelve hours to be fit for use.

Litharge follow boards are expensive, but are the best known, and if to be much used are certainly the cheapest, inasmuch as they are not liable to shrink, swell or crack, and if the joint line is altered on the pattern the repairing or altering in any way is easily performed. Follow boards 36x36x1 inches have been made of this material by nailing the oiled sand with nails 4 inches apart to the bottom board. Follow boards can be made thinner with oil, and consequently lighter, being more durable than of plaster. To coat plaster or oil follow boards with black shellac is good practice.

Wooden follow boards are often used, and frequently a hole or slot in the board is all that is required, but where the joint line is irregular wooden boards are too expensive, besides being subject to atmospheric conditions that are annoying. Where there are but few castings to be made from a pattern the molder will quickly make a follow board from molding sand. He should, and usually does, have frames of various depths, for either upsetting flasks or for quickly making molding sand follow boards for temporary use. It may be in place to say that the follow board is used to place therein the pattern upon which the nowel is rammed, and when the nowel is turned over and the board removed the joint is wholly or partially ready for the cope to be rammed upon it after the parting sand is on.

Russia's Trade in Machine Tools.

There is perhaps, at the present time, no other market in the world which should offer such excellent opportunities for the sale of machine tools as Russia. The country is exerting itself to the utmost to increase the capacity of its engineering industry, and we hear almost daily about immense amounts of capital being invested by foreigners—especially Belgians and French—in Russian mechanical establishments. Large stock companies, backed by leading European banking institutions, are constantly being formed. Paris, Brussels and St. Petersburg are generally the headquarters of these new industrial enterprises, while the works themselves are being erected all over the Russian Empire.

During the last year, 1899, no less than forty-four stock companies were formed in the mechanical line (foundries, steel works, machine shops, shipyards, etc.), with an aggregate capital of 49,655,000 rubles.* In the metallurgical and mining industries fifteen new companies were started whose combined capital amounts to 35,000,000 rubles. Of other new formations in 1899 the following may be mentioned: Textile industry, thirty-three companies, with 35,750,000 rubles capital; chemical industry, sixteen companies, with 15,800,000 rubles capital; sugar mills, twenty-five, capitalized at 13,100,000 rubles; electro-technical works, seven companies, with 8,900,000 rubles capital; construction works (bridges, etc.), twenty-seven companies, with 17,000,000 rubles capital.

The total number of new stock companies formed during the last year in Russia was no less than 363, of which

*The value of a Ruble (paper) is 50 cents or a trifle more.

fifty-three were foreign, and the aggregate capital of these new enterprises amounted to about 428,000,000 rubles.

Railroad building is being rushed vigorously; hundreds of new lines are either contemplated or already in course of construction, and all the Russian engineering works are overcrowded with orders, many of them not being able to accept any more orders for years to come. That such an extraordinary activity in the whole iron trade creates heavy demand for machine tools is but natural. It is shown in the official Russian customs returns, according to which the imports of all kinds of machine tools increased by almost 50 per cent. in 1898 over those of the previous year. In 1897 the Russian imports were as follows:

From Germany	$863,880
" Great Britain	508,040
" Belgium	156,120
" France	37,440
" Sweden	42,640
" United States	35,360
Total	$1,643,480

In 1898, however, the value of the machine tools imported amounted to no less than $2,304,120. The figures for 1899 are not yet available, but it is estimated by reliable Russian authorities that the imports in 1899 will prove to have surpassed even those of the year 1898.

In many Russian shops the old standard types of machine tools are still largely in use, although in most of the engineering works engaged in the manufacture of first-class engines, war materials, bicycles, etc., the most improved and latest American tools can be found. This explains to a certain extent the fact that Germany and Great Britain still take the lead in the Russian machine-tool trade, though for many years already precision tools have been imported from the United States.

In comparing the above figures, however, it should be borne in mind that considerable quantities of American machine tools find their way to Russia *via* English and German ports, thus appearing in the official Russian returns as of German or English origin. This explains the high figures with which these two countries—Germany and Great Britain—are credited in the Russian statistics.

A glance at our own statistical returns confirms this view. For the fiscal year ending June 30, 1898, for example, the exports of "metal-working machinery" from the United States to Russia are given as follows:

To the Baltic and White Sea ports of Russia	$138,418
To the Black Sea ports of Russia	1,941
Total	$140,359

Following are some details of different British, German and American machine tools chiefly sold in Russia in 1898, viz.:

Radial drilling machines, on rail; origin, English:

	Nos. 29	30	31
Radius, feet	4	5	6
Hight of drill above rail, feet	3½	4	5
Diam. of drill, inches	2¼	2½	2¾
Weight, pounds	7,950	9,720	11,880

Radial drilling machine, of English make:
Radius—3½ feet.
Diameter of drill—2¼ inches.
Weight—3,420 pounds.

English double, triple and quadruple drilling machines:
Number of drills—2.
Will drill—18 inches.
Hight of drill above table—12 inches.
Dimensions of pulleys—9 x 2½ inches.
Weight—1,670 pounds.

Universal shaping machine, English make:
Diameter of circular table—2 feet.
Revolutions per minute—250.
Countershaft pulleys—12 x 3½ inches.
Weight—3,960 pounds.

Considerable quantities of special machines used in the manufacture of torpedos, shrapnel and other projectiles, as well as machine tools used in making cartridges, quick firing guns, etc., are also imported from Great Britain.

Engine lathe with automatic feed attachment, also to be used for screw cutting, of German origin:

(1) Average type—			
Hight of centers, ins	7	9	12½
Length of bed, feet	6	8	12
Dist. bet. centers, feet	3½	4½	7½
Weight, pounds	1,440	3,000	5,600
(2) Heavy type—			
Hight of centers, ins	6½	8¼	11
Length of bed, feet	8	12	16
Dist. bet. centers, feet	5½	8½	11½
Weight, pounds	1,550	3,150	6,400

Engine lathe, with automatic feed attachment, also to be used for screw cutting; country of origin, United States:

Heavy type—		
Hight of centers, inches	15	15
Length of bed, feet	12	29
Distance between centers, feet	6½	23½
Weight, pounds	8,800	14,000

Ordinary lathes of English construction:

Hight of centers, ins	12	14	16
Length of bed, feet	10	18	20
Dist. bet. centers, feet	5¼	11	12
Weight, pounds	5,000	8,650	12,800

English double axle lathes for locomotives and car wheels:

Hight of centers, ins	22	31	60
For wheels of diameter of, inches	44	60	120
Dist. bet. centers, in	108	108	108
Approx. weight, lbs	18,000	31,700	67,700

English revolving lathes:

Hight of centers, inches	5½	6
Length of bed, feet	4	4½
Weight, pounds	575	650

American revolving lathes:

Hight of centers, inches	6½	10
Length of bed, inches	50	100
Approximate weight, pounds	1,475	6,120

English screw-cutting engine lathes:

Length of bed, feet	5	7
Weight, pounds	1,620	3,060
Revolutions per minute	100	120
Pulleys, inches	12x2	16x3½
For bolts and nuts of inches	⅝ to 1	⅝ to 2

Steam hammers, English makes:

Weight of hammer, lbs.	220	800	2,240
Diam. of cylinder, ins.	6½	10	14½
Length of stroke, ins.	14	24	33
Total weight of hammer, pounds	2,700	6,250	14,250

The trade in machinery and machine tools in Russia is to a large extent concentrated in Moscow, where it is almost entirely in the hands of German firms. All these firms keep a permanent stock of the machines and tools most in demand. Some of these Moscow firms keep as many as fifty machine tools of different makes permanently in stock. These machines and tools are sold without any guarantee. Several houses act as agents of an English or German manufacturer, but, at the same time, they are at liberty to import and sell any other make.

Others make a greater specialty of hardware, fittings, etc., but sell also machine tools.

It seems, however, that there is a distinct tendency for a specialization of the trade nowadays. Already the Russian market demands from the importer of machine tools a good technical knowledge of the article he sells, a deeper knowledge than that which the hardware dealer generally possesses.

The machine tool import merchant in Russia who is anxious to do business must be an experienced engineer, who knows the advantages and drawbacks of the different makes and able to give any technical information as to the handling in question.

There are only two or three firms at present in Moscow which make a specialty of distinct lines. They are:

J. M. Summer & Co., complete plants for cotton mills.

A. Erlanger & Co. and A. J. Hesse, complete plants for flour mills.

Zotoff Bros., complete installation of sugar and oil plants, etc.

But there are, so far, no houses which are exclusively engaged in the installation of engineering works.

A Belgian Government official, Mr. Cobbaert, in a report recently sent to the Foreign Office at Brussels, advises Belgian engineering firms desirous to enter the Russian market successfully to establish an office, well equipped, at Moscow, and estimates the yearly expenses of such an engineering and sales bureau as follows:

Rent	3,000 rubles
Taxes	1,000 "
Commercial agent	5,000 "
Two draftsmen	1,800 "
One engineer	2,500 "
Bookkeeper	2,400 "
Office and traveling expenses	15,000 "
Miscellaneous expenses, etc	3,300 "
Total	34,000 rubles (or about $18,000)

As a general rule, the average net profit of any enterprise in Russia is estimated at 20 per cent. Taking this calculation as a basis, a yearly business turnover of 170,000 rubles would be sufficient to cover the total expenses of the Moscow bureau and depot.

This idea is doubtless a good one, though it is not new. There are quite a number of German manufacturers who have their own branches in Russia, and

this is especially the case in the electric line. We think, however, that the appointment of a reliable agent, who must, of course, be an engineer, or a business man with ample engineering knowledge, who should canvass the field, would be a cheaper means to get at the trade. These agents work on commission, and when they are backed up by the manufacturer in the way that the latter (either personally or by a competent representative) visits the market at least once a year, they doubtless can secure a good share of the Russian orders, especially when they are known in the engineering works. Be this as it may, under all circumstances American machine tool makers should be able to do a far larger trade in Russia than has hitherto been the case. But in order to attain this end they cannot too often be reminded of the same old story—that catalogs printed in English will never create any business in the czar's dominions.

For general information it may be added that as a rule machine tools ordered direct from the German or English works, *i. e.*, not taken from the stock on the spot in Russia, are always 3 to 5 per cent. cheaper in price. To counterbalance this, however, payments must be made in a shorter period than when delivered from the Russian depot. The Russian import merchants in most cases run an account with the German or English manufacturers and settle every three months. Terms of payment differ very much in Russia, and generally depend upon previous arrangements. There are, however, many rich and honorable houses in Russia which pay exclusively cash, and transactions with those firms would, of course, be the best.

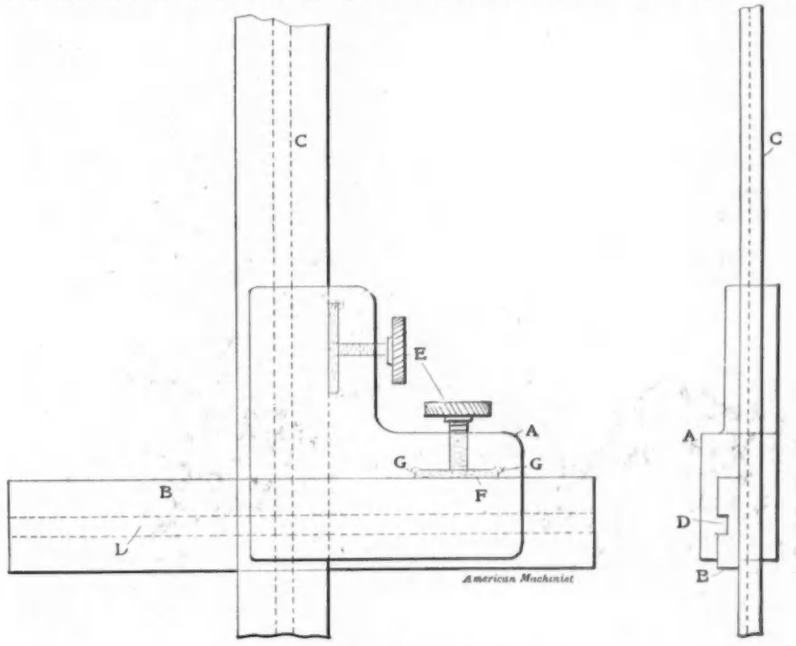
The city of Moscow is doubtless a first-class distributing point for the whole of Russia. It is the center of the cotton, silk, leather, tobacco, spirits, copper and brass industries, of a great number of large foundries and engineering works, the junction of eight railway lines, affording easy communication with all parts of the empire, the White Sea, St. Petersburg, the Baltic, Poland, Kieff, the South, the Volga, the Caspian Sea, Turkestan, the Ural and Siberia. With its large surrounding industrial centers Moscow counts a population of about three million people, thus offering a valuable market in itself alone. The enormous importance of Moscow as a market, however, is to be attributed to its immense trade with other parts of Russia, for which it serves as a kind of commercial center, an almost cosmopolitan market, where the manufactured goods of Western Europe are hauled at the same time with the agricultural products of Siberia, the cotton from Turkestan, the wines and fruits of the Crimea and the fish of the Caspian Sea, the Black Sea and the Volga.

In many quarters the general opinion prevails that with the completion of the great Trans-Siberian Railway and the extension of the Trans-Caspian railway system Moscow will soon outrank the market of Nijni-Novgorod, the place where the greatest Russian fair is held. A foreign manufacturer who seeks information on the Russian market in ninety cases out of a hundred goes to Moscow, and Moscow nowadays certainly deserves the name of Russia's "Commercial Metropolis."

H. L. G.

A Square and Depth Gage.

The accompanying figure shows a combined square and depth gage. In my past position of inspector of pattern work I found it necessary (on the automatic screw machine class of work) to use a try square a great deal. I found that the body part of the square which rested on the surface plate was usually too long, so that I could not use it to advantage. I therefore decided to make one which could be adjusted. As will be seen by the figure, *A* is the body and *B* and *C* are blades which slide at right angles to each other in *A*. *B* and *C* are held in place in *A*, and are also held square by the tongue and groove *D*. The blades are clamped in place by the thumb screws *E*, which bear against a spring *F*. The spring *F* holds the blade from sliding too freely when the thumb screw is slackened. It also prevents the edge of the blade from being defaced by the point of the thumb screw. The spring *F* is held in place in *A* by inserting the ends in the hole *G*. This prevents the spring from falling out when the blade is removed.



A HANDY SQUARE AND DEPTH GAGE.

It will readily be seen that this is not only a good square, but a very good depth gage as well. The tool was first made with 4 and 9-inch blades, but a blade 24 inches long was afterwards added, as it was found to be quite valuable. It seems to me that this tool should be very valuable in other lines of work.

H. D. VAN DOORN.

Providence, R. I.

A Self-Propelling Air-Hoist, With Unlimited Travel.

The half-tone Fig. 1 shows very clearly a novel and remarkable traveling air hoist which cannot fail to excite the interest of shop readers. The apparatus is all that the picture suggests. It is a complete air hoist which travels as far as the overhead rail extends in either direction, going around curves, or switching to other lines, as required, with a constant connection with the air supply, all under the control of the operator who rides with it. It is, however, not necessary for an operator to ride with the trolley, as it can be made to travel between points, starting and stopping automatically. In that case the hoist and motor are operated by pendants from the floor. The motor and the hoist, wherever they may be along the line, are both always in full connection with the air supply, and without any hose to look after or any outside connection.

The means by which the air supply is conveyed to the trolley and the connection constantly maintained will be understood from Fig. 2. Along the runway of I beams is suspended a feed pipe of cold-drawn steel tube, and this is covered by a thin steel casing which normally is closed, but which is capable of springing apart at the bottom. The air tubes are in 8-foot lengths, and are joined together by couplings which form a bearing for a valve in each with the valve operating mechanism. The couplings and the pipe have a true and uniform continuous surface externally. Surrounding the air pipe is a

flexible receiver of such diameter as to allow a given area between the outer wall of the feed pipe and the inner wall of the receiver. The receiver travels with the trolley, and connection is made to the trolley through a hollow arm which is a part of the receiver and extends down through the slot in the casing. The lengths of the feed pipe being 8 feet 6 inches from center to center of valves, the length of the receiver is 9 feet, so that one valve is always open inside the receiver. The ends of the receiver fit the outside of the feed pipe with self-packing stuffing boxes. These ends, externally, are made conical, so that as the receiver passes along the pipe the conical surfaces raise the tappets attached to the valve levers. The conical mouth of the receiver raises the tappet and a longitudinal rib within the receiver keeps the tappet up until it emerges at the other end of the receiver. When both tappets of either lever are up the valve connected with the middle of the lever is raised, and when the tappet drops the air valve is closed again. In Fig. 2, supposing the receiver to be moving to the left, the right-hand valve is seen to be open, and the first tappet of the left-hand valve lever has been raised. When the second tappet is reached and raised, the left-hand air valve will be open, and almost immediately, if the movement of the trolley and receiver continues, the right-hand valve will close, and thus the valves will be opened successively, and the pressure in the receiver will be maintained.

Fig. 3, showing the trolley and motor, requires little explanation here. The motor is of the three-cylinder type. With the pressure applied to the outer ends only of the cylinders the trolley can attain a speed of 400 feet per minute, if necessary. The motor runs at such a speed as to develop all the power required to move the trolley with its heaviest loads; the motor shaft carries a small pinion which connects with the largest gear, and small gears on the same shaft connect with intermediate gears that mesh into gears on wheels on both sides of the trolley. Levers for reversing and for the throttle are provided. After the air has done its work in the motor, instead of allowing it to exhaust into the atmosphere, it is led through another hollow arm back into the casing, which naturally creates a stronger air pressure flowing from within the casing than the atmospheric pressure without, thus preventing the possibility of dust settling on the feed pipe and valves. This exhaust air at the same time carries oil in the form of spray from the motor, which serves to keep the feed pipe well lubricated.

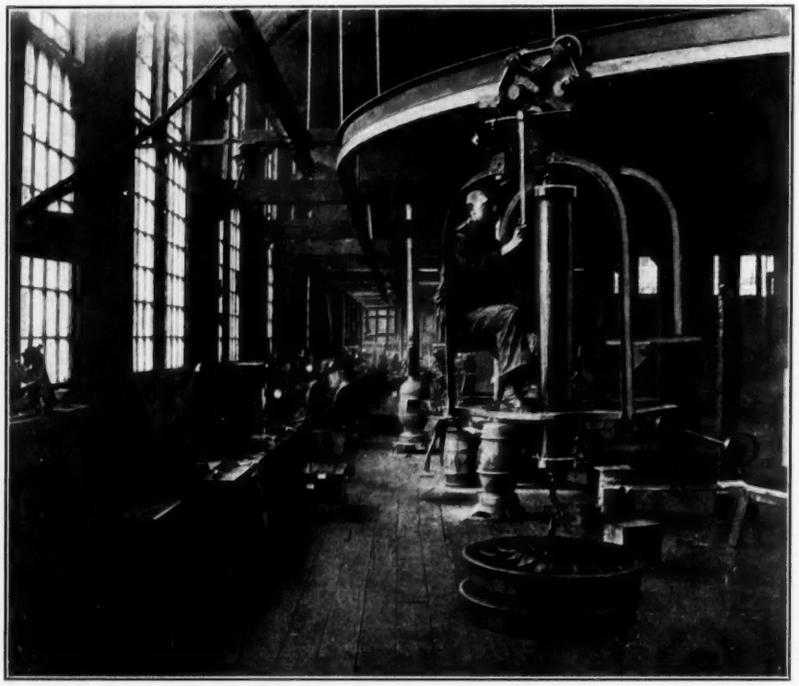


FIG. I. A SELF-PROPELLING TRAVELING AIR HOIST.

At switching points the pipe casing and beam are broken in order to shift the main track to the switch track. The switch ends of the feed pipes are plugged, and the air supply is led to the other ends of the pipes.

The hoist, Fig. 4, has some original features. In air hoists, as usually operated, the air for hoisting is admitted under the piston, and when the load is to be lowered this air is discharged into the atmosphere, the weight of the load being sufficient to bring it down, although when there is no load the weight of the piston and rod is not always sufficient except for very slow movements. The usual air hoist, therefore, normally has no air pressure upon either side of the piston. In the present hoist there is full air pressure

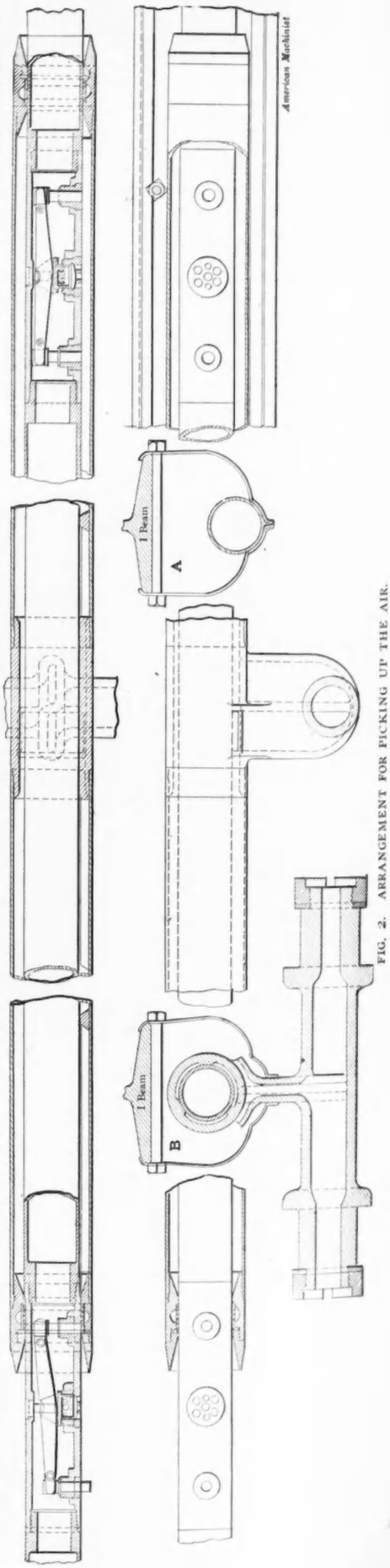


FIG. 2. ARRANGEMENT FOR PICKING UP THE AIR.

upon both sides of the piston, except when hoisting. The air pressure is conveyed to the lower side of the piston by means of the vertical pipe seen within the cylinder. The upper end of this pipe is in constant communication with the air supply and the lower end of it in as constant communication with the lower end of the cylinder. There is a stuffing box in the piston where this pipe passes through it. The piston also has on both sides of it a wooden block, which serves as a buffer and prevents the shock of metal to metal when the piston touches either end of the cylinder. No operating valve is connected to the lower end of the cylinder. When a load is to be hoisted the pressure is released from the upper side of the piston and the hoist ascends. For lowering, the pressure is readmitted above the piston. When the pressure is on both sides of the piston there is an unbalanced pressure downward equal to the area of the piston rod below, and this differential pressure operates in addition to the weight of the parts to cause the piston to descend. This apparatus is made by the Pneumatic Crane Company, Pittsburgh, Pa.

Miss Annie Rainsford French, who is well known in New York social circles, and whose profile adorns the brass tablet of the cruiser "Olympia," has just been granted an engineer's license by the District of Columbia Commissioners. She is the first duly qualified woman engineer in the capital city. Miss French does not aspire to be a mechanical engineer, other than to run her own locomobile, although she has taken the regular examination, which tests her qualification for such a position.—"Washington Post."

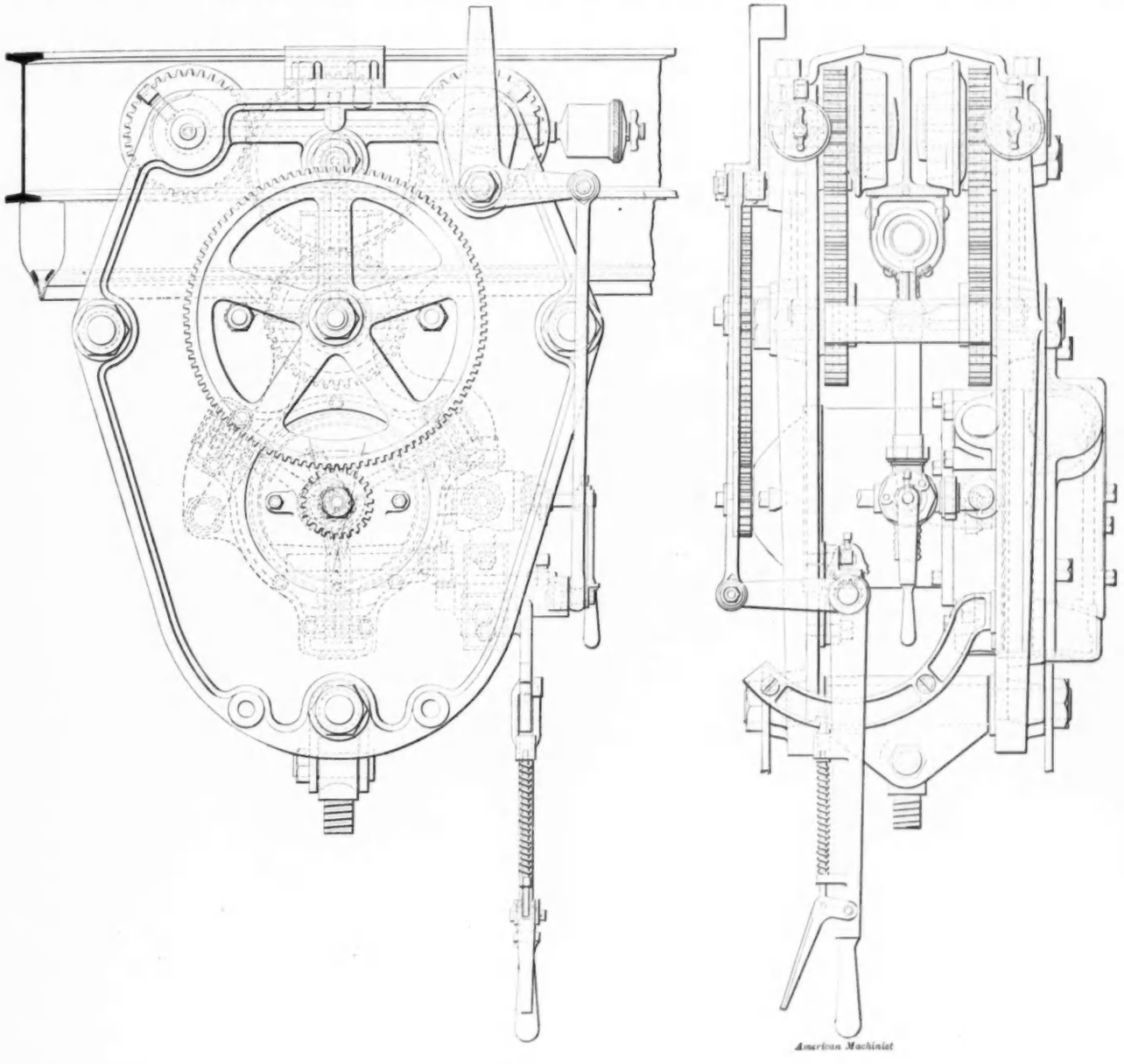


Fig. 3

TROLLEY AND MOTOR.

Letters from Practical Men

Draftsmen Wanted.

Editor American Machinist:

It is a wonder to me, and it has been for a long time, that young fellows in the shops do not catch on to the fact of the extreme desirability of skill in mechanical drawing, and that they do not more generally take time and pains to acquire it. The mechanical draftsman is the one solitary handicraftsman (in so far as mechanical drawing is a handicraft) whose occupation has not been narrowed and diminished by the application of machinery to it. Some hand work has been materially curtailed, many operations of it have been annihilated, by the advent of the automatic machine. Original drawings of machinery, however, are not yet made by machinery.

and are not likely to be. Mechanical draftsmen are more important and necessary than ever before. They are apparently scarcer than they may have been at other times in the past, not because they are actually less numerous, but because they are more numerously required. Here is at least one place where the demand has not sufficiently stimulated the supply. I was looking through the "Help Wanted" department in a recent issue of the "American Machinist," and I found that, by actual count, one-third of all the advertisements were specifically for draftsmen, while several of the others were for positions where drafting ability was one of the implied requisites, so that for one-half of all the ads. of help wanted in that issue the call was for a draftsman. This is not a sudden development; except, perhaps, in degree, it is the usual condition of affairs Times must be bad indeed when a draftsman is not wanted somewhere.

Of course, in all these cases where anyone advertises for a draftsman, it is something more, and it is usually much more, than a draftsman that is called for. The mere ability to make the lines—straight, circular and of the correct radius, or curved regularly or erratically, light, heavy, dotted, broken, all in correct position and relation—is a very small part of the work that is wanted. Copyists or tracers, although there is always considerable work for them, are not the kind of goods that is in demand. The art of the copyist, if not of the tracer, however, may in its acquisition be the opening to all the rest. There may at the first, perhaps, be nothing better for practice or training than the copying or reproducing of good samples of mechanical drawings. Many good draftsmen of to-day have begun by copying drawings that have appeared on the pages of the "American Machinist," where good and correct drawings are the rule, and where some of the best work of the best drafting rooms in the United States is reproduced. The necessity usually of drawing to a different scale than that of the printed copy is an advantage, and an additional means of educating the faculties which the draftsman is required to develop.

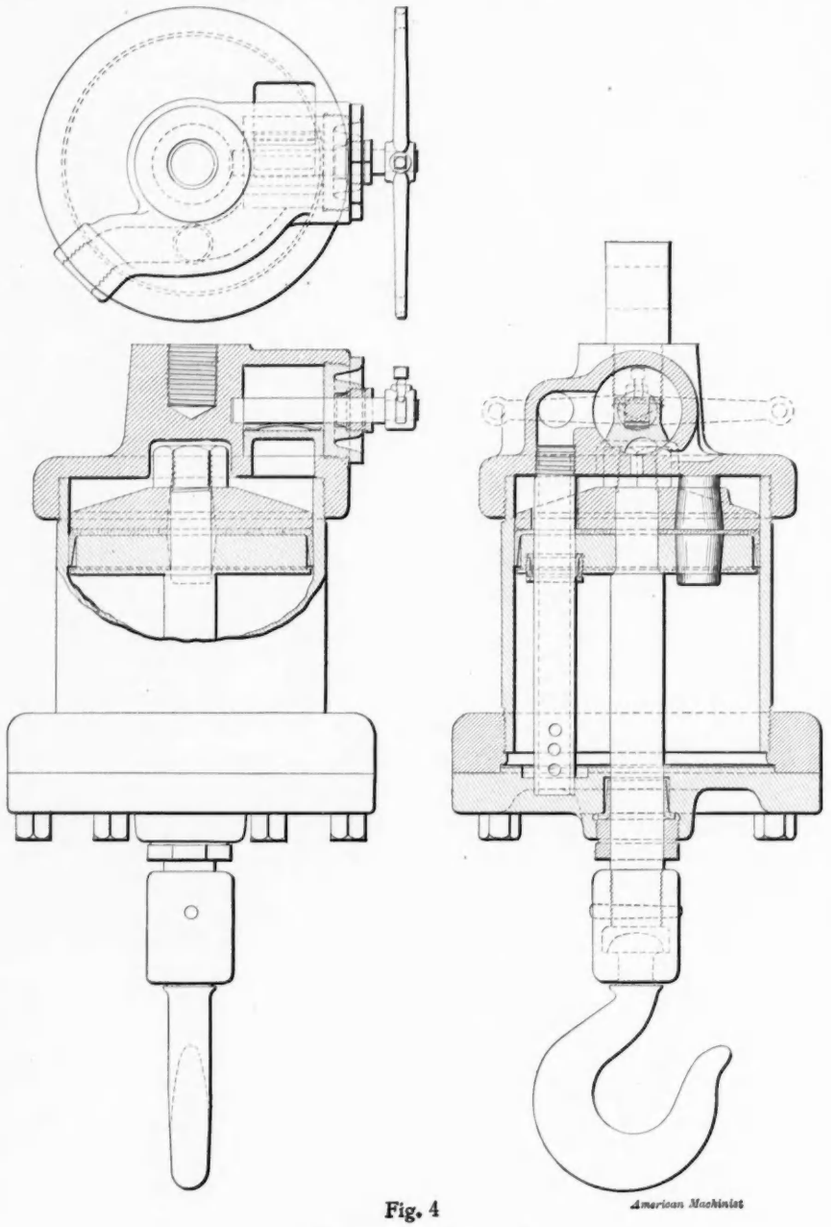


Fig. 4

DETAILS OF AIR HOIST.

But one cannot go along very far in the copying of drawings, and in acquiring the skill involved in making correct and good looking work on the paper, without beginning to think beyond that. The why of things encountered is constantly demanding explanation. In the case of working machines the relations of the several parts to each other to produce the correct movements have to be understood, and then the sizes and strengths required at the different points, so that each shall be relatively as strong as the rest, without superfluous material all around, invite investigation.

But when it comes to original drafting, the delineation of machines or structures complete and in detail that have never yet existed, this kind of knowledge, which seems to be an incidental thing with the copyist, is then the essential thing, and not the making of the marks. All the great inventors and engineers of the world have been draftsmen above everything else, but draftsmen rich in these higher attributes. Watt and Stephenson and Corliss and Ericsson and Edison have been draftsmen in the higher sense, although they may not all of them have had equal facility with the pencil and the pen, and it is kinship with these that constitutes the draftsmen that all are looking for.

One peculiar feature of the draftsman's opportunity is that it takes hold of all the mechanical occupations, and of one almost as much as of the other. It is not in the least monopolized by the machinist, and it is not the necessity of his shop more than of the others. The pattern maker certainly has quite as much to do with working drawings, and why not also the molder, the blacksmith, the boiler maker, the carpenter, the coppersmith and all the rest? It will be to the immense advantage of the workers in any of these lines, and to the young man a most presumptive means of advancement, to be not only able to read drawings, but to make them.

Besides the usefulness and applicability of the draftsman's skill in all the mechanical lines, is the equal accessibility to all of the means of acquiring it. Anyone in any trade can take hold and make of himself a draftsman. They will not all be equally good draftsmen, of course, because natural aptitude for this line of occupation will count, and also the general propelling force of the individual. No matter what is to be done in life, a man of a hundred horse-power will do more than one of ten

horse-power, and if his power is only that of one jackass you may expect to see his cart at the tail of the procession. But, aside from that, no trade has any opportunity or advantage opening toward the drafting room that is very much greater than that of any other trade. Anyone can get a board and a sheet of paper (there are two sides to all the earlier sheets), a T-square, a cheap pair of compasses and a couple of triangles, and then he is ready to begin. The best kits of half a century ago did not include the triangles. A little later he may get one or two pairs of better compasses, beam compasses, a few sweeps or means of drawing irregular curves, and then he will have all the tools in that line that he will need for a lifetime. A draftsman's kit costs very much less than a pattern maker's or a tool maker's, and yet it may command much better pay, with unlimited possibilities of advancement beyond.

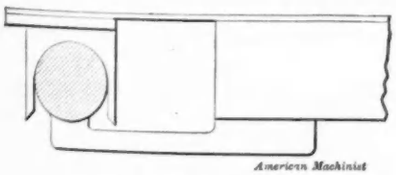
A draftsman can also become expert, as many, if not most, of those now active have become, without the aid of a professional teacher, or without attending any school for the purpose. Drafting is learned by doing it, and the ways of doing it come along as they are required, or any of the all too numerous textbooks on drawing give solutions of the problems that are not obvious. For the larger qualifications of the draftsman as I have hinted at them, they must be diligently and constantly cultivated by every available means, and beyond this it is not easy to say much. TECUMSEH SWIFT.

A T-Square Guide.

Editor American Machinist:

I have been much interested in the various forms of parallel motions for drawing boards which have been described in recent issues of the "American Machinist," and I venture to send a sketch of a very simple arrangement which I have used with much satisfaction.

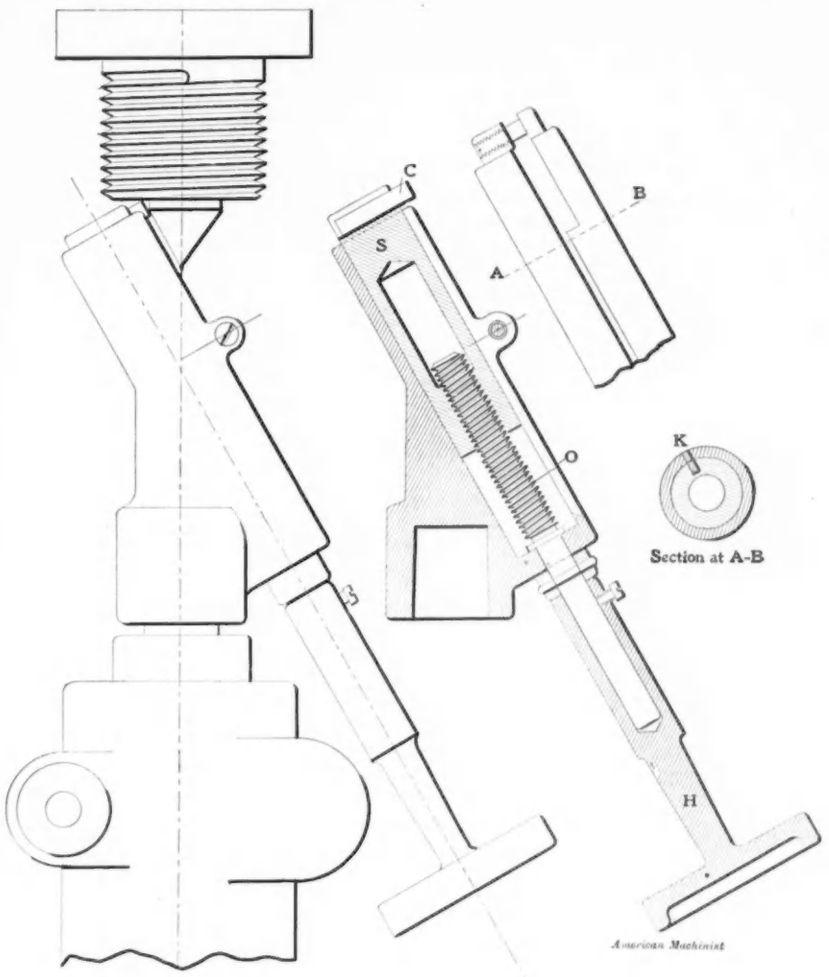
It consists of a round, straight rod attached to one side of the board by brack-



A T-SQUARE GUIDE.

ets, as shown, and then two small brass pieces attached to the usual T-square head and fitted to slide accurately upon the rod complete the arrangement. The blade of the T-square, being free to turn upon the rod, can be raised when moved from one part of the board to another, thus avoiding soiling the drawing and pushing articles lying upon the board; or it may be removed entirely and replaced as easily as when used in the ordinary way.

B. J. WILLEY.



RIG FOR TRUING LATHE CENTERS.

Rig for Truing Lathe Centers.

Editor American Machinist:

I send you sketches of a device designed some time ago for the purpose of truing the live or head centers of lathes. While writing this I recollect an editorial you published some time ago, in which you stated that no up-to-date shop should use a soft center. While heartily agreeing with you that hard centers are the ideal centers, I am of the opinion that it is not the prevailing practice to use them, a condition due either to the inconvenience of using grinding fixtures or to the failure of managers to provide them.

Referring to the sketch, *S* is a cylindrical slide carrying a cutter *C* and moved back and forth by means of handle *H* and screw *O*, and prevented from turning by key *K*. Adjustment for size of cut is obtained by moving the foot spindle. It will be noticed that if the device is properly made, the angle produced will always be right. It does the work well and quickly, requiring no belts or rigging to bother with and to tempt a man to put off doing what he knows is necessary to produce good lathe work. W. R. G.

Automatic Variable Feed for Drill-Press.

Editor American Machinist:

Some time ago you described a special drill press designed for reaming the hubs of agricultural wheels, which had a variable feed to spindle—slow while cutting and rapid while the reamer was passing through the chamber in middle of the hub.

While the machine will undoubtedly do good work, as it is ingeniously arranged and the details carefully worked out, it seems to me the same end may be accomplished more directly and much cheaper.

Some time since, in building a gang drill for our own use, we had the same problem, and met it by the use of a variable feed cam, which has worked perfectly, was very cheap in first cost, and never gets out of order. In this machine the drills advance rapidly to the work, feed slowly through first side, rapidly through chamber, slowly through other side, and then have a quick return to original position and remain at rest long enough for operator to change the work, when they start on the same cycle of operations again.

In using this device one cam may be

used to operate the table, feeding all spindles at once, or a separate cam may be used for each spindle, so set as to start one drill after another, so that the operator can work down the line, replacing one piece at a time.

In applying this scheme to the drilling of square tubing we met an unexpected difficulty, as there were so many fins inside of the tubes that the drills broke badly in starting through the second side of the tube. We finally gave up drilling them in this way, and now drill through one side, reverse the tube in the jig and drill through the other side.

In designing machinery for use in agricultural shops we have learned to place simplicity above everything except efficiency.

WILSON P. HUNT.

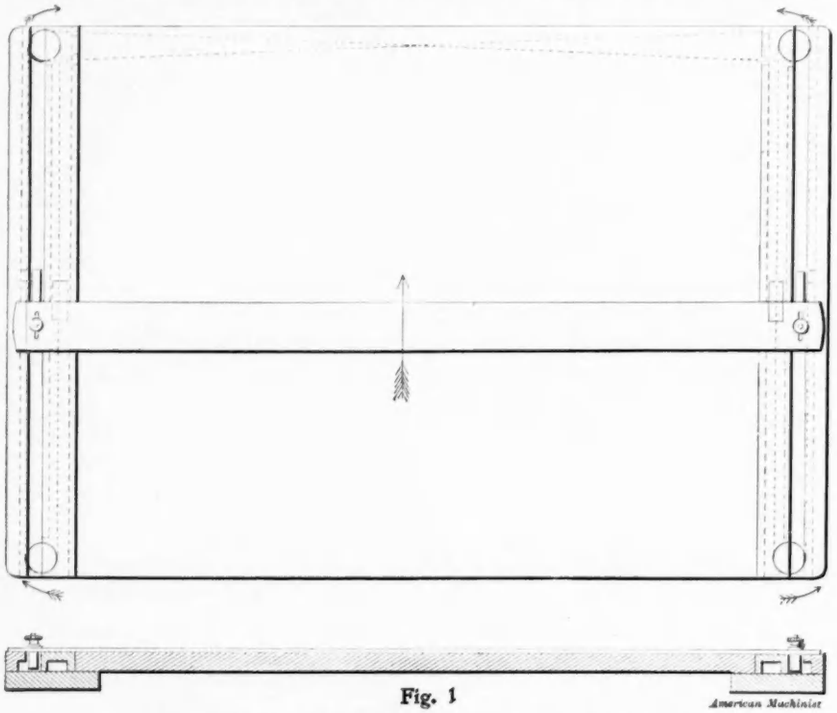


Fig. 1

A PARALLEL RULER ARRANGEMENT FOR A DRAWING BOARD.

A Parallel Ruler for the Drawing Board.

Editor American Machinist:

The several contributions relating to parallel ruler attachments for the drawing board which appeared in your columns not long ago were of great interest to me, so that I am induced to send you sketches of another which has had a thorough trial and been found eminently satisfactory. The device has been applied to a frame, in which a drawing board is inserted and easily removed, and also to a board without such a frame. The latter is illustrated here. Its essential detail is, besides the straight-edge, an endless cord running over pulleys at the four corners of the board. The manner of winding the cord in my arrangement is peculiar to itself, but will be readily understood from the sketch. In tracing the course of the cord it should be remembered that the upper two pulleys are double grooved, permitting the cord to pass twice over each; thus only four pulleys are used, and they are so placed as to all run in planes parallel to the board's surface. The reduced number of the pulleys and their disposition brings about the advantage that they, as well as the cord, may be easily covered, as shown, by means of suitably shaped woodwork. In no place is the cord exposed to view, nor has the straight-edge any projecting ends, and it is consequently evident that this arrangement does away with the objection due to projecting and exposed delicate parts liable to accidental injury. Only the roughest misuse can therefore disturb its accuracy of parallelism and adjustment. I should point out that the cord, where it passes crosswise between the upper double-grooved pulleys, runs in channels at the under side of the board. These channels have not been shown, in order to reduce the number of dotted lines on the drawing.

Another advantage worthy of note grows out of this design. Whenever it becomes desirable, and in my opinion it is nearly always so, to raise the board to a more or less upright position, the weight of the ruler must be taken care of. Here an excellent opportunity is afforded to attach a counterweight to each portion of the cord that runs opposite the ruler attachment, without the addition of extra pulleys, and since this weight slides in a plane always parallel to the path of the ruler its balancing effect on the latter must remain correct in whatever angular position the board may be placed. This latter condition does not prevail when the ruler is balanced, as is sometimes done, by a weight vertically suspended, in which case the counterpoise is correct for one angular position of the board only.

Fig. 2 shows by enlarged details the manner of attaching the ruler to the endless cord. I believe that the drawings are sufficiently plain to permit the omission of a verbal description, and I will therefore confine myself to an explanation of the objects aimed at with this construction. The link that intervenes between the point of attachment to the cord and the end of the ruler permits the lifting of the latter a short distance when drawing paper is put on the board. This movement of the ruler is also particularly of advantage in permitting the passage across a wet ink line. The screw around which the cord makes one turn for fastening to the upper end of the link is at this point square, to prevent slipping, and it is evident that when the ruler is lifted from the board said square portion rolls in the cord loop without causing any disturbance of the cord tension or the ruler adjustment. The curved surface of the opposite end of the link and the correspondingly formed washer between it and the ruler permits the adjustment of the latter to the surface of boards having different thicknesses.

Chicago, Ill. JOHN SVENSON.

What Books Shall I Get?

Editor American Machinist:

In trying to get information on this subject I think there is one side of it that is frequently lost sight of by both parties, and that is that it is special, and not general, information that is looked for. Take a youngster just learning the machinist trade. He is told how to set and grind his tools for some certain work, and soon learns by experience how to set them to get good results on that work, but he very seldom gets any idea that the matter of clearance is of general application to cutting tools of every kind used in the shop. By observation he finds that some men can make tools that work the first time they are tried on a new job. Someone else tells him—or he reads it—that he ought to study up on the trade. He don't know what to read, but is ambitious enough to send for a catalog, gets it and finds a book of which the publisher says: "Should be in every live machinist's library, and no one that wishes to be in the front of his trade can afford to be without it," etc.; price $2.50. Just the book surely. He scrapes together five days' wages, sends for the book and gets something for experts and specialists—a book that he might need ten years hence. The book that he did really need was named in the catalog, but he didn't know it, and he needed someone to give him an introduction.

Perhaps from his surroundings the only someone he can think of is Mr. Tecumseh Swift, or the editor of the "American Ma-

chinist," in both of whom, like others of us, he has great confidence. So they receive a letter asking for a list of books, and perhaps it is rather vaguely stated and the position of the writer is not clearly grasped, and he may not even here get just what he needs. In that case, though, it is safe to say that some readers of the paper are benefited.

As the young man advances in life, if he still keeps up the habit of reading and studying, his library enlarges, and it is an instructive study. Here is a book, a textbook, meant for schools and colleges. Just what he needed. He also needed a teacher to enable him to use it. Another one, just alongside of it in the catalog, was much better for his use; assumed less and gave as much as he needed, but he didn't know it.

So it goes all along the line. Here is a volume, a compilation of trade catalogs. There one, a very primary primer of odds and ends, to be taken like patent medicine —on faith; there another, with differential calculus on the second page. All good books in their places, but now in the wrong place, or gotten at the wrong time.

Cannot Mr. Swift, or some other with wisdom, get up a book or rule or formula by which a greenhorn can find out what he needs to know, and in what class of books, and what books of the class, he can get it with the least expenditure of money and time? I would like to get a list myself of the books that give as much arithmetic, algebra, geometry, trigonometry, analytical geometry, calculus, machine design, mechanical drawing and physics as can be used to advantage in the shop by the fellow of average intelligence, who has made up his mind to try.

The man who learns all about all of them sometimes has not had time enough left to learn much else, and if so he is useless in applying them to shop practice.

While recognizing that there is no royal road to learning, it should be also kept in mind that "in making of books there is no end," and that one small head is hardly large enough to hold *all* there is to know on any one subject unless it is compressed to such an extent that the head is liable to burst at any time, even if it has nothing but the one subject confined there.

And most machinists want to know something on a whole lot of subjects; not too much, though, because they have more subjects than they will ever get to anyway. The man who will help us in our need will deserve a monument of the heaviest and longest chips that our craft can make, set on a perfectly round shaft, resting on a geometrical plane of cast iron.

W. OSBORNE.

The Clutch Milling Problem.

Editor American Machinist:

I offer the following as a solution to Mr. William H. Smith's "Problem in Clutch Milling" (issue of February 1):

Gear the spiral head to angle *A* (referring to Mr. Smith's drawing) and use a cutter of the angle *B*, or less; hold the clutch blank in the chuck horizontally, the top of the blank level with the center of the cutter. Feed in to the required depth *C*; back out and raise the work, say, ⅛ inch; feed in again to the depth, and so continue until the cutter finishes to the inner end of the clutch tooth. Index for the other teeth and finish in the same manner.

I take it for granted that the dimension *D* in Mr. Smith's drawing is an error, and should be the perpendicular face instead of the inclined one.

I have by demonstration satisfied myself of the correctness of my theory, and how well I have succeeded you will see, as I forward to you the result of my experiment, also the tool I did the work with. I selected a pitch of 4.46 inches per turn, and geared the spiral head of the milling machine accordingly, then turned a piece of composition to 2½ inches in diameter, which would leave angle *A* approximately 60 degrees; and, with a 1-inch hole, would leave angle *B* about 35 degrees. After making three attempts, I found the required depth and set the stop accordingly. After cutting the first finished notch to this depth, I backed the work away, raised the work one-half turn (.050 inch) and fed in again. As you can see, there are about fourteen fine waves, showing the work was raised and fed horizontally to the cutter fourteen times for each notch.

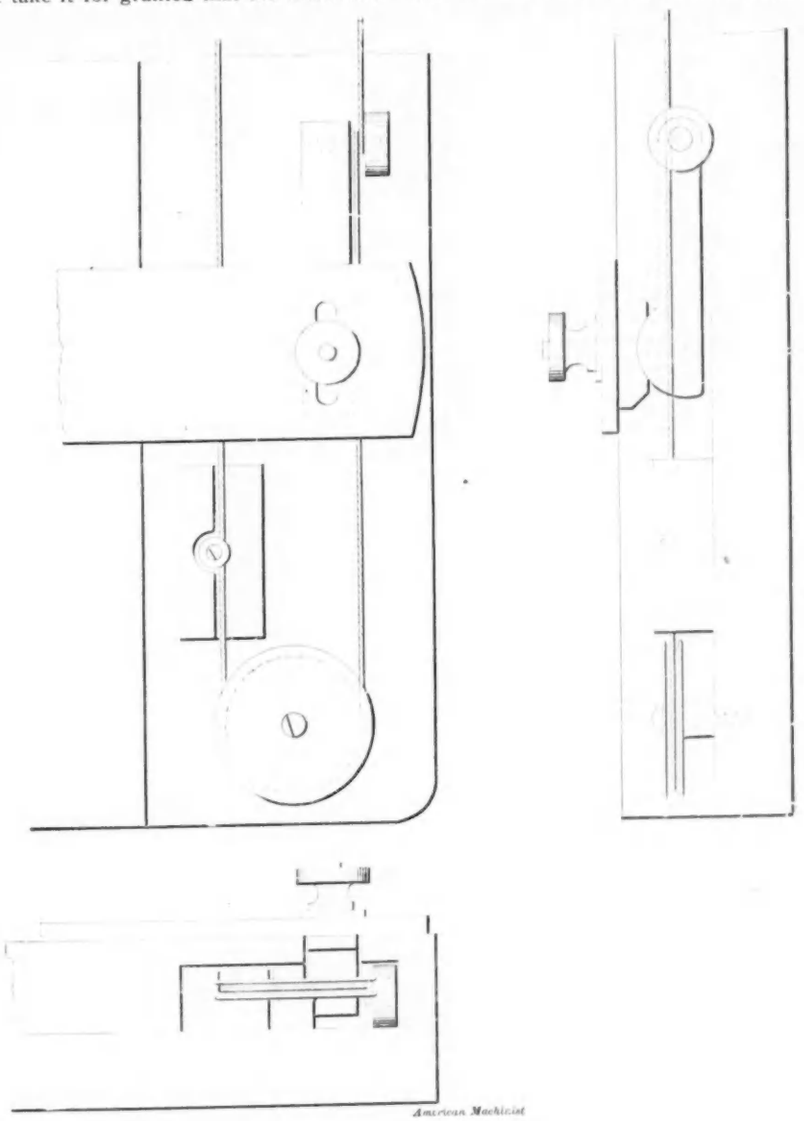


Fig. 2

DETAILS OF PARALLEL RULER ARRANGEMENT.

You will notice a different method on the last notch. Instead of feeding in and backing out so many times, I fed in about 1-64 inch, then fed the work upward so as to make a groove of that depth across the face, fed in another sixty-fourth, and lowered it, etc., until the required depth was reached.

After cutting the part off containing the teeth I sawed out three teeth to see how well they matched, and I leave it to your

judgment whether or not I have fulfilled Mr. Smith's requirements.

It would be necessary to have roughing and finishing cutters to do an accurate job.

If there were several such clutches to be made I am quite sure they could be planed more economically than milled.

Vallejo, Cal. W. G. LUPER.

[The description given above is a little difficult to understand unless one is perfectly familiar with the universal milling machine. It is understandable, however, and of itself shows that it will produce the result stated in the problem, while the sample of work proves it; the three teeth cut out of the ring and reversed so as to engage with the others fit perfectly at both ends. We do not, however, understand how they could be planed more expeditiously than they can be milled. Some indexing device is obviously necessary, and as the cutter (or tool) is fed into the work the latter must be rotated. The milling machine has the index device needed, and the spiral gears do the rotating as the cutter is fed into the work, whereas the planer is not provided with either of these facilities, and something would have to be made to take their places.—Ed.]

A Cure for the Loose Pulley Nuisance.

Editor American Machinist:

The writer had nearly forgotten that there was such a thing as the loose-pulley nuisance, until happening a few days ago to be in another shop, the once familiar squeal of the loose pulley was heard for the first time in several years. There is a very simple, easy way to arrange them so they will give no more trouble than other bearings. It is not a make-shift, but a radical removal of the cause of all the annoyance. It doesn't cost anything either. When a loose pulley gets balky it is as cheap to fix it this way as any other, and if done properly, it will stay fixed. The reason there is so much trouble with them is very plain indeed. The shaft wears smaller and the hole wears larger, and all the thousand and one loose-pulley oiling devices that have been invented will only partially mitigate the unmechanical condition of a big hole trying to run on a little shaft.

If the shaft always stopped in the same position there would be no difficulty, for instead of wearing all sides of the shaft alike, the wear would all be on one side. That side would fit the bore of the pulley and all would be lovely, until the shaft wore in two. It is hardly practicable to stop a countershaft always in one place, but it was just that kind of a shaft, with the loose pulley always wearing on one side, and which, in consequence, never made any trouble, that some years ago suggested the idea of making a sleeve or bush for the loose pulley and securing it so it could not revolve, thus making the pulley run on the bush instead of directly on the shaft.

The sketch shows the method of preventing the bush from rotating—simply a rod bolted to it and running up to the ceiling, where it goes through a hole in a piece of board or may be secured by a link, any way which will prevent it from turning, yet not hold it so rigidly as to make it bind. Some very obstinate loose pulleys were first cured in this way, and then it was made a standard thing. As fast as pulleys bothered, they were bored out and the non-revolvable bushes fitted.

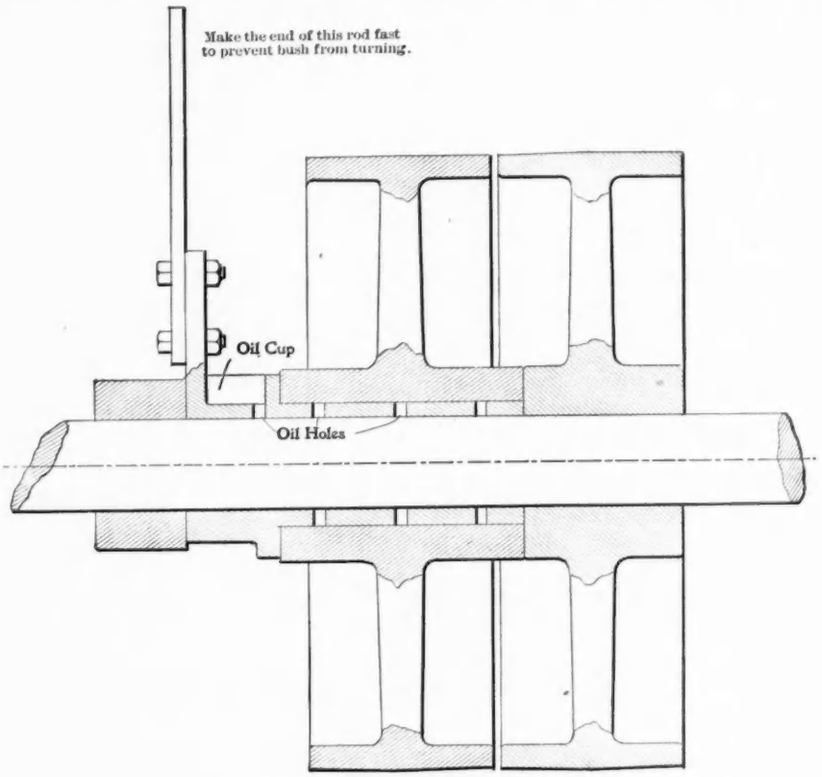


FIG. 1. A CURE FOR THE LOOSE PULLEY NUISANCE.

Some of these bushes, in several years of extremely hard service, have worn through—of course on one side. Instead of fitting new bushes, the old ones were simply turned half-way over and secured in position to wear out the other side.

One reason, however, for these bushes wearing through was that they were of bronze. It was soon found that cast iron was a much more suitable material, and that, running with the cast-iron hub of the pulley, the wear was very slight indeed. About 3-16 inch to each 1 inch of shaft diameter is a good proportion for the thickness of the bush, giving proper wearing thickness without unduly enlarging the bore of the pulley. Several oil holes should be drilled through both top and bottom, and if an oil groove is cut from the oil cup cast on the bush, so as to lead the oil inside along the shaft, no other means of oiling is ordinarily needed.

The worst trouble with the scheme is that it cannot be applied to usual forms of clutch pulleys, and this has led in several instances to their being discarded and tight and loose pulleys arranged in this way substituted, with much better results. It simply adds another good reason to the already existing ones for not using clutch pulleys on countershafts.

E. J. ARMSTRONG.

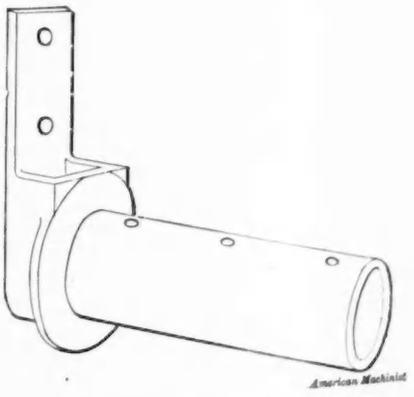


FIG. 2. PERSPECTIVE VIEW OF BUSHING.

Proportions of Sub-Presses.

Editor American Machinist:

During a recent tour of a number of shops engaged in the manufacture of small light goods in quantity, the writer was struck by the limited use of the sub-press for making many of the smaller parts of thin sheet metal. Further reflection led to the conclusion that outside of the watch and clock industries the merits of these useful tools had not been fully appre-

ciated. They are stiff, accurate, reliable and convenient, and are quite independent of the wear of the gibs and slide, with the attendant inaccuracy of the parts of larger presses.

The accompanying Fig. 1 and table of dimensions are the outgrowth of an attempt to design a line of sub-presses fulfilling the following conditions, named in the order of their assumed importance:

(1) Accuracy.

(2) Strength and stiffness.

(3) Lightness—within the limits imposed by 1 and 2.

(4) Convenience.

(5) Cheapness of construction and maintenance.

The frame is cast with a cored hole in the center, tapering 2 degrees. The shape of the core provides four semi-circular grooves *d* the whole length of the hole, for the purpose of anchoring the babbitt shell. The hole is made tapering to facilitate the removal of the babbitt when renewal becomes necessary.

The bottom is faced and hole *G* bored with an inward taper of 1 degree. To this hole the stem of the base, having a hight of ¾ inch, is carefully fitted and the base fastened to the frame by two screws *b b*. The plunger is turned, tapped for plug at *O* and ground to gage. Four semi-circular grooves are cut in the plunger, unequally spaced to insure its proper subsequent entrance in the shell. The plunger is then held central in the cored hole in the frame by suitable means, and the babbitt shell poured around it. From two to four pointed, headless screws *a* are tapped into the frame as shown, to preclude possibility of disturbance of shell from accidental causes.

The bottom of slide of a larger press is arranged to receive a plug, which is screwed into the plunger, the frame strapped to the bed of the press and run until the plunger is a proper working fit. An oil pocket at the top of the shell is a convenience.

Plugs for the different sizes of sub-presses are of the same dimensions, so far as the length and fit in the bottom of the slide of the large press are concerned, varying only in diameter of collar *P* and thread *O*. The pitch of the thread is the same also—20 per inch.

In use the tools are preferably left in the sub-press as a permanent fixture; but they may, of course, be removed readily, and quickly interchanged with certainty of alignment, independent of any changes that may have taken place in the meantime in the larger press.

In a form of construction preferred by several firms making these tools, the rounded top of the frame is dispensed with and the sides made straight to the top instead. A thread is cut in the cast iron, to which is fitted a case hardened spanner nut, which screws down hard against top of the babbitt sleeve, presum-

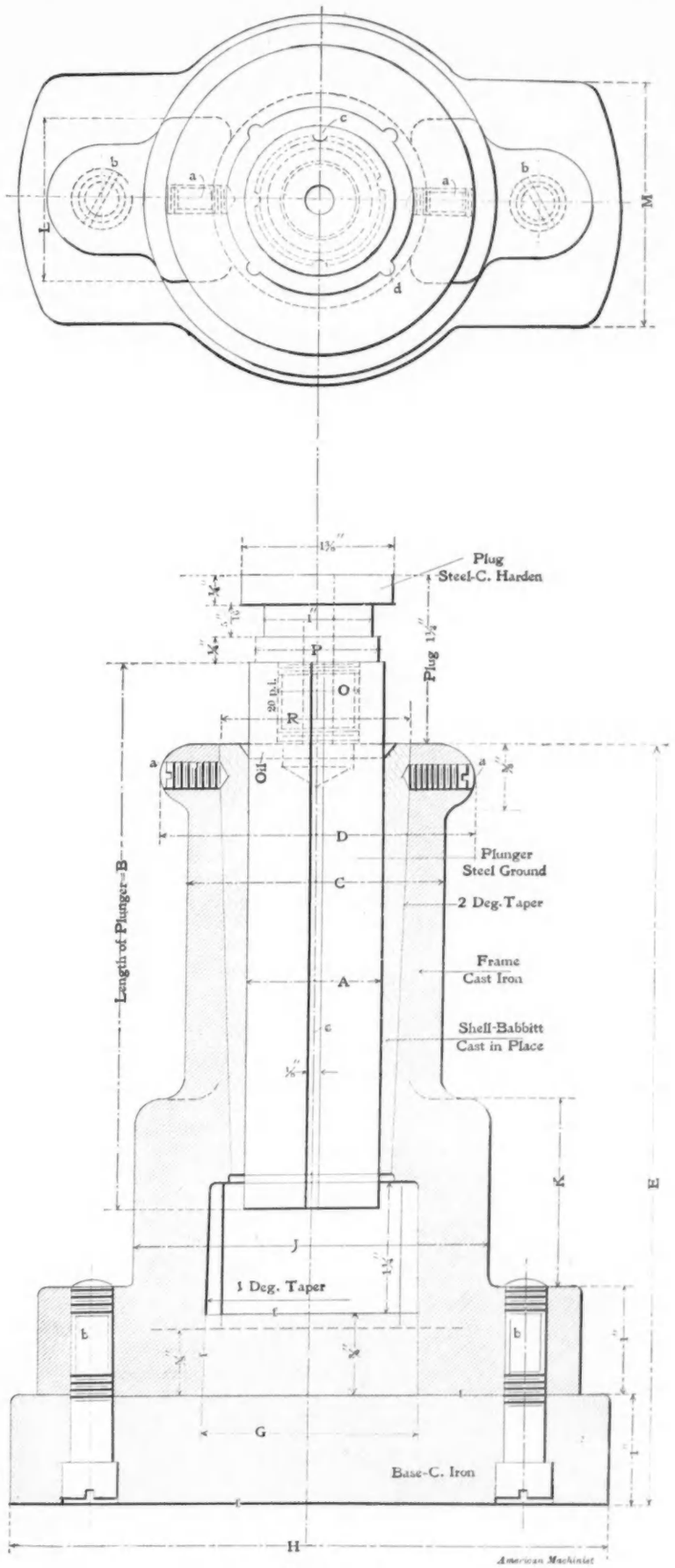


Fig. 1

PROPORTIONS OF SUB-PRESSES.

ably squeezing it into the taper in the frame. So far as the writer's experience goes, the only point this design possesses, that the form shown in Fig. 1 does not, is expense. But in case this form is preferred, proportions for it are given in Fig. 2 and the accompanying table 2.

L. B. CHARLES.

TABLE 1.

TABLE OF DIMENSIONS FOR SUB-PRESSES.

Press No.	A	B	C	D	E	G	H	J	K	L	M	O	P	R
1	1¼	5	2⅜	2⅞	7	2	5½	3¼	1¾	1½	2¼	¾	1⅛	1¾
2	1¾	5	2⅞	3⅜	7	2½	6	3¾	1¾	1⅞	2½	1	1½	2¼
3	2¼	5	3⅜	3⅞	7	3	6½	4¼	1¾	2¼	2¾	1¼	1¾	2¾
4	2¾	5	3⅞	4⅜	7	3½	6½	4¾	1⅞	2½	3	1½	2	3¼
5	3¼	5	4⅜	4⅞	7	4	6½	5¼	1⅞	2¾	3½	1¾	2¼	3¾
6	3¾	5	4⅞	5⅜	7	4½	6½	5¾	1⅞	3	3¾	2	2½	4¼

TABLE 2.

Press No.	a	b	c	d	e
1	2¾	2⅛	5/8	9/16	¾
2	3¼	2⅝	5/8	9/16	¾
3	3¾	3⅛	11/16	5/8	13/16
4	4¼	3⅝	11/16	5/8	13/16
5	4¾	4⅛	¾	11/16	⅞
6	5¼	4⅝	¾	11/16	⅞

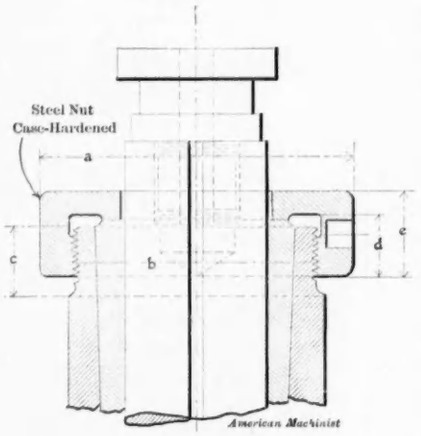


Fig. 2

A MODIFIED DETAIL.

Gas Engine Information.

Editor American Machinist:

The writer was much interested in the article published in your April 12 issue, and entitled "The Open Door in Machine Shops," in which "Theorastus" made some timely comments in regard to the business methods of at least one gas engine builder. You may be interested to know that there is one concern in the United States which does not pursue the same short-sighted policy. We do not like to appear to be booming ourselves unduly, but it is a fact on record, that ever since we started to manufacture and sell stationary, marine and automobile gas engines, we have pursued the policy of inviting the closest inspection and investigation of our work, both in our shop and out of it, and have published in all of our catalogs and advertisements the cylinder areas and brake horse-powers in every possible way, and absolute and complete information in regard to our engines. We are always ready to furnish a prospective customer, or in fact anyone interested, with the actual working blueprints as used in our shop, provided they are willing to pay a reasonable price for the same, and we send you, under separate cover, two copies of what we term our working model, which, together with the printed description and photo engraving of an engine assembled and dismantled, shows up every detail of our method of construction.

We believe if a concern intends to market gas engines or any other machine, that it then becomes to a certain extent public property, and it is not only unbusiness-like but ridiculous to attempt at the same time to sell and market an article and yet endeavor to withhold and keep as a secret all the essential details of its construction. Our rotary valve, which is used to hold the charge in the crank case, is protected by patents and is our property, otherwise all we claim for our engine is proper and judicious design and good and perfect workmanship, and the more information we can give our prospective customers, the better pleased we are, and we sincerely hope that all the manufacturers of gas engines will adopt this same policy in the near future, which is certainly the only correct and business-like one to adhere to.

J. F. DENISON,
The Denison Elec. Eng. Co.
New Haven, Conn.

"Old Tools Superior to Modern."

Editor American Machinist:

The article in your paper No. 14, taken from "The Engineer," of London, seems to me to have been written by one who does not understand the present status of the tool trade, and it does not do the subject justice; it is obviously unfair and one-sided. That he can find cases such as he describes I have no doubt, for I know of such personally. Some people have carried the improved tool business to extremes, and overshot the mark by constructing just such a complicated machine as is described.

In a certain armory a machine was built that would drill every hole in a pistol lock frame, besides other work, at one chucking or placing. It was complicated, with slides, hinges, etc., to fix the proper positions for drilling the different holes and to perform various other operations, but it was found to be troublesome to take care of, and needed an exceptionally good man to run it. It was abandoned for three or four simpler machines for doing the same work. The tendency has been since then in this armory to make cheaper and simpler machines; but there do still exist in this country, as well as in all others, mechanics calling themselves inventors, who make just such complicated machines. There are machine tool makers in Europe (as well as in America) that claim to construct a machine which is a lathe, planer, gear-cutting machine, milling machine, hand lathe and drill, and which costs about as much as the six machines it pretends to embody. One man only at a time can use this machine, when six could be employed on the six simpler machines. In America we have little use for such complicated machines; the tendency now is to simplicity. For the European market every engine lathe must have a compound rest, which is not as rigid as a solid rest, and which we find very little use for on small lathes; and from inquiry among our best practical machinists and from my own observation, in not one lathe in fifty is there any use for a compound slide rest. Again, we and others in this country are making machines (not complicated) which are making a saving in cost of production of 80 per cent. of former costs. The writer of the article in "The Engineer" should have known these things and should have stated them, if he desired to do himself and the subject justice. One would judge by his article that very little improvement had been made over the old style of machine tools.

F. A. PRATT.

Old Suggestions of "Practical Men."

Editor American Machinist:

As Mr. Armstrong asks in the "American Machinist" No. 15 as to how many have profited by the kink suggested by Prof. Sweet in the 1887 volume, it occurs to me that, while I cannot answer that question, I nevertheless feel it my duty to say that many other kinks have aided me as a mechanic and an executive; and I would say further that the reader who does not profit by any of the suggestions either has no opportunity to try them or does not care to progress, or possibly belongs to that majority who know it all, and knew it all years ago.

As I turn over the pages of the 1887 volume it occurs to me to ask, has anyone profited by the suggestion of Mr. Walter E. Crane (see April 23d number) as to design of lathe shears? To judge by the modern lathes produced, someone has. Then it occurs to me that someone has not forgotten the suggestion by Mr. W. D. Forbes in the September number, to judge

by some Western machines. Then, Mr. Grant's articles have certainly borne fruit. Yes, some kinks are overlooked, but many are taken up; look up your old volumes then look around.

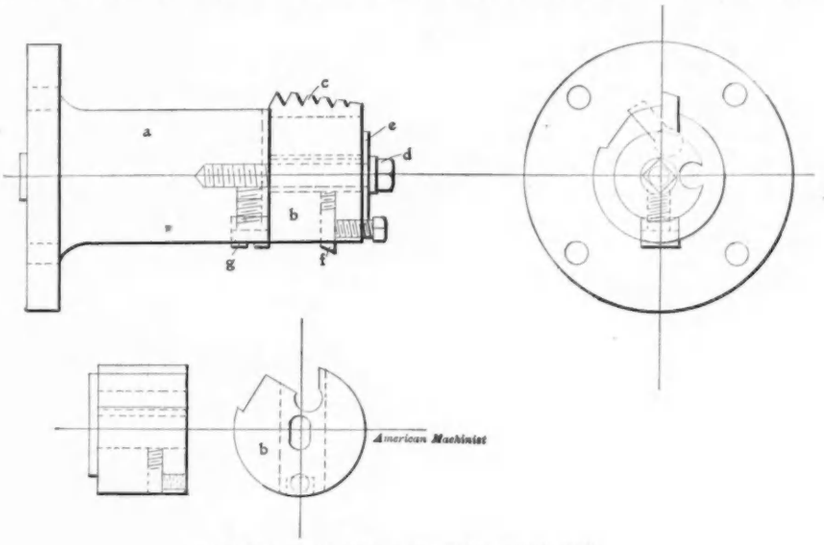
JOHN G. NIEDERER.

East Rutherford, N. J.

A Face-Plate Boring and Threading Tool.

Editor American Machinist:

In the "American Machinist" of March 8, "J. A. B." describes a job, and illustrates the tool used to do it, a face-plate boring tool. The tool illustrated is a very good one, but, as "J. A. B." points out, it is slow—a serious defect these days. As he asks for quicker methods, I will tell how I would—or it may be safer to say how I *think* I would—do the job, and the accompanying drawing will serve to illustrate it.



FACE-PLATE BORING AND THREADING TOOL.

We will assume that the casting to be threaded is recessed so that the tool will run clear in passing through, though this is not necessary, as the lathe can be stopped at a certain place, leaving the job much as a taper tap would do. *a* is the body of the bar, which is bolted to the face-plate; *b* a steel head, which is tongued and bolted to *a* by bolt *d*. *b* is cut away as shown to receive the cutter *c*, which is made like an ordinary chasing tool. *e* is a washer to hold the chasing blade in position, and has a hole in edge to allow removal of blade for grinding. *f* is a boring blade or tool, which is held in place and backed up by screws.

The center hole in *b* is elongated to allow adjustment by screw *g*. The blade *c* has a sheet-metal bib to keep chips out of the slot, and *b* is cut away to clear it when *c* screws forward.

To use the tool, we will fasten *c* in forward position by a small screw in the bib, or we may remove it through hole in the washer; then set *f*, which may readily be done with a scale. After the hole is bored, remove *f*, put *c* in back position, close nut on lead screw, and let her go. When the cut is through, stop the lathe with the cutter on top, turn back a little when cutter will take forward position and clear, allowing carriage to be run back by hand. If my calculations are correct, we will now have a finished thread from one trip through, though there will probably be spring enough to leave a good chip for a second cut.

In cutting the thread on the chaser it should be blocked forward slightly, and when finished, it will have the clearance of a formed mill, and can be ground on the face without changing the form.

I never got this tool beyond the paper stage, so would like to know if "J. A. B." thinks the scheme practical. TEDDY.

Qualifications an American Must Possess to Become a Successful Machine Tool Salesman in Europe.

Command of the French and German languages, while not absolutely necessary, is a great deal in your favor. Be conversant with metric measurements, and learn to compute the currency of the several countries in relation to that used in the United States.

If you are dealing through agencies, as a rule they have the prices on stock machines figured out in the currency of the country.

Dress neatly; a plug hat is not essential to secure business either in England or on the continent; it is what you cover with your head gear that counts. Acquire a thorough knowledge of the machines and tools you are trying to sell, with their several details, and a knowledge of a general line of machine tools for manufacturing purposes is a good asset, as it gives your customer a certain confidence that you seem to be well posted.

Never venture an opinion on any subject that you are not up to date on; admit at once that you really are not familiar enough with it to discuss it. If you are asked to give an opinion on machinery made by a competitor in the States do not hesitate to say that you believe the tools are good. If, on the other hand, you know the tools are bad and do not bear a good reputation, simply lie and say you don't know. Never run down a competitor; leave this for the travelers of the European agencies. You will find them past masters in that branch of the trade.

Do not make extravagant claims for your tool, and be careful about naming rate of their production. Study the conditions under which the work is being performed, and if possible get some idea of the temper of the metals used, and base your statements of output accordingly.

When tendering a specification be careful of the wording, that you do not bring a suit for damages down on your company for breach of contract. The safest way is to make all tenders subject to the confirmation of your company upon the receipt of drawings or finished models, with forgings, castings, or a sufficient quantity of the bar iron or steel from which the pieces are to be made. If, after the receipt of the said models, castings, etc., your company accepts the order as per your specification, your responsibility is at an end, and it remains with your company to thoroughly demonstrate the production before shipping the machinery.

If you should be invited to visit a large works in the capacity of an expert, and with the idea of making an examination of each department for the purpose of disposing of your tools, do not return to the office and state that you find the methods fifteen years behind the times, as this is equivalent to saying that the head of the department has been robbing his employers for that length of time, or that the managers have been in a trance and are not up to the latest methods of manufacturing.

Use a little tact, and state that from your hurried observations you were unable to form any definite conclusions, and ask that you be allowed to spend more time with the different foremen. If you see a chance to place one of your tools, hint around it and let the suggestion come from the foreman. He will be pleased, and it won't do you any harm.

If you tender a specification or quote prices for machinery, be not surprised if your competitor is shown your offer, as you can also see his quotation without much trouble, and the best man wins, regardless of price, seven cases out of ten.

Keep your firm posted as to your movements, and report all breakages in shipments and the causes thereof. Note improvements in the equipment of cutting tools and fixtures that have been made by your customers who have had the machines some time, and report the same to the home office, with explanatory sketches.

Offer suggestions as to the equipment of machinery with new tools, as you are on the ground and understand the conditions under which they will be worked. Your suggestions will be received at the home office by the rank and file with contempt, and you will have developed a swelled head, etc., but trust to the good sense of some one of the management to see that your ideas are carried out, and insist upon it being done.

Your company should keep you posted, either directly or through their agents, on the business accruing from your visits, or you will find it embarrassing when making a call on a customer on being queried as to the delivery of machines that were ordered since your last visit.

In order to retain your trade you must call on the customers at least once in two weeks, time and extent of territory permitting. Never refuse to don the oilers to demonstrate the working of a machine tool that you have sold.

Keep yourself posted on all new devices of the day by a careful perusal of advertisements and reading columns of the "American Machinist," which you will find in the offices of any concern of importance in Europe. EX. P. RIENCE.

New Catalogs.

We have received from the Park Manufacturing Company, Charlotte, N. C., a catalog illustrating and describing the Moffatt feed water heaters, variable stroke power boiler feed pumps and deep-well pumps, which they manufacture. The pamphlet is 5¼x6¾ inches in size.

Horsburgh & Scott, Cleveland, O., manufacturers of raw hide and cutters of gears, send us their catalog. It is filled chiefly with priced tables of gears of different dimensions. At the end are a few pages of information on gearing. The catalog is of standard size, 6x9 inches.

The Hoefer Manufacturing Company, Freeport, Ill., sends its illustrated catalog, No. 5, of friction and other drill presses, power hack saws, saw blades, drill chucks, furniture and bed-spring machinery, wire straighteners and cutters, bicycle machinery, etc. It is of standard size, 6x9 inches.

We have received a catalog of the University of Vermont and State Agricultural College, Burlington. This institution has in its curriculum courses, among others, leading to the degree Bachelor of Science in Civil, Electrical and Mechanical Engineering and Chemistry. Size, 5¼x7½ inches.

"The Hanging Crane" is a little book containing views and a description of the new shops of the H. W. Caldwell & Son Company, Chicago, manufacturers of elevating, conveying and power-transmitting machinery. The plant is a model one in its appointments. Size of pamphlet, 8¼x5¾ inches.

The Miller Lock Company, 4523 Tacony street, Frankford, Philadelphia, Pa., has published its catalog No. 14, which is occupied with illustrations, prices, etc., of the company's varied line of door, pad and other locks, including the "Champion," "Lincoln," "University," etc. Size of page, 6½x9¾ inches.

The Challenge Machine Company, Philadelphia, Pa., has issued the edition for 1900 of its pocket catalog, wherein is illustrated and described its extensive line of emery grinding and polishing machinery. The King 14-inch swing vertical drill is another product of this company. Size of Pamphlet, 3½x6 inches.

The Triumph Electric Company, Cincinnati, O., sends a catalog of the generators and motors it manufactures. It is plentifully illustrated, the salient details of the machines being shown in separate plates. In the back are ten views of the motors applied to different kinds of machinery. The catalog is 10x6¾ inches.

The Rochester Gas Engine Company, Mill and Furnace streets, Rochester, N. Y., has issued a pamphlet showing the gasoline vapor motors manufactured by them for marine work and also some launches. One of the leading features of the engines is a reverse friction clutch of their invention. The catalog is 9¼x6 inches.

We have received the catalog for 1899-1900 of the Syracuse University, Syracuse, N. Y. In part the college offers courses of study leading to the degrees of Bachelor of Science, Electrical Engineer, Civil Engineer and Bachelor of Architecture. Lectures on the theory and construction of heat engines are to be given by John E. Sweet. Size, 5½x8¼ inches.

The Schenectady (N. Y.) Locomotive Works have issued, supplementary to their catalog, a pamphlet of illustrations and dimensions of locomotives recently constructed at their works. Among these are engines for the Kiushiu, the Imperial and the Nippon railways and the Mitsui Mining Company of Japan. Size of pamphlet, standard, 9x6 inches.

The Iroquois Iron Works, 178 Walden avenue, Buffalo, N. Y., have issued an illustrated catalog of machinery and tools for asphalt pavements. The assortment of apparatus here shown includes steam rollers. One feature is a patented railway plant consisting of asphalt paving machinery mounted on two cars, so that it can be transported from place to place where the expense of a permanent plant would not be warranted. Standard size, 6x9 inches.

We have received from the Brightman Manufacturing Company, Millersburg, O., its

(*Continued on page* 47.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 20.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer. Mach. T. Co., Meriden, Ct.

Punches & dies. Wal. M. Wks., Waltham, Mass.

Draftsman's novelties. D. Kelsey, N. Haven, Ct.

Shaft'g straighteners. J. H. Wells, Tampa, Fla.

U. S. and Canada patent for sale, cheap. Address Box 240, AMERICAN MACHINIST.

Wanted—Will buy or rent small machine or bicycle repair shop. Box 326, AMER. MACH.

Will purchase bound set Int. Cor. Schools' Mech. Engineering Course. L., care A. MACH.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J. L. Lucas, Bridgeport, Ct. Send for index sheet.

Cam cutter wanted, a second-hand P. & W., in first-class shape. National Mach. & Tool Co., 253 A st., Boston.

Wanted—To purchase, complete drawings for six sizes of dough mixers. Address Baker, AMERICAN MACHINIST.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Address of William Salmond, machinist, from Canada. Address Mrs. Eliza Salmond, 76 Grange ave., Toronto, Ont., Canada.

Would be pleased to correspond with parties having some specialty in the line of light machinery to build or model work. Address Box 475, Hornellsville, N. Y.

Wanted—Second-hand lathes, in good order, from 30 to 36 in. swing, 10 to 14 ft. bed, also smaller sizes ; state condition, prices and maker's name. Backus Water Motor Co., Newark, N. J.

For Sale, at Sacrifice—A manufacturing foundry and machine shop in Chicago suburb ; established paying business ; five railroads ; brick buildings ; plenty of land. Address Box 42, Griffith, Ind.

"Loetzer's Hand-Book of Practical Rules and Tables for Machinists and Engineers" ; revised and enlarged fifth edition just out ; cloth binding, 65 cents ; full leather binding, $1 ; agents wanted. C. E. Loetzer, Sayre, Pa.

Wanted—Partner with capital, by experienced mechanic ; start foundry and machine shop ; cheap fuel ; free site ; correspondence requested with "broad-gage" men ; opportunity for your son if he is worth the trouble. Address Box 327, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical engineer and designer of 20 years' experience, desires position. Address E. F., AMERICAN MACHINIST.

Situation wanted as toolmaker, or experimental work ; 10 years' experience ; references. Box 333, AMERICAN MACHINIST.

Experienced draftsman, 5 years shop, 6 drawing room ; special and automatic machinery preferred. Box 334, AMER. MACHINIST.

Steam engineer and millwright of experience and ability, wants position, mill or factory ; economic methods. C. A., AM. MACH.

Designer wishes to change ; special machines, tools and fixtures for interchangeable work ; good all-round man ; formerly in charge. Box 335, AMERICAN MACHINIST.

Foreman desires change ; all-round machinist and toolmaker ; experienced on engine machine tools, electrical and automatic machinery ; A1 references. Box 329 AM. MACH.

Superintendent, considerable experience on special machinery and tools for manufacturing light machinery, stamping, hardware, etc. ; technical. Box 328, AMERICAN MACHINIST.

Expert on gas and gasoline engines, 10 years' experience in constructing, erecting and testing engines, in charge of shop 6 years, wants engagement to utilize his knowledge. E. H., AMERICAN MACHINIST.

Chief engineer or master mechanic, 30 years' experience in foundry, shipbuilding and underground railway construction, will accept position with railroad company or manufacturing concern. Box 316, AMER. MACHINIST.

Mechanical engineer and draftsman, technical graduate, wishes to change from present position ; 18 years' experience as foreman, superintendent and master mechanic in shops producing small and medium duplicate machinery. Address Box 321, AM. MACHINIST.

Superintendent open for engagement ; a thorough practical mechanic, with large experience in the manufacture of ornamental brass and bronze work ; many years' practical experience in the manufacture of electrical instruments and light machinery ; thorough in modern shop practice, expert in tool-making and economical mgr. of help. M. H. N., AM. M.

Position wanted by first-class mechanical engineer and draftsman (40), to take charge of drawing office ; experienced on marine engines, high-speed and Corliss engines, pumping engines, ice machines, blowing engines, installations of light and power plants, structural work, etc. ; 12 years of shop and 14 years of office experience. For further particulars address Box 330, AMER. MACHINIST.

Help Wanted.

Wanted—Good mechanical draftsman for pump work ; must be No. 1. Box 287, AM. M.